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Risk Assessment Framework Addendum (Revision 2)

This document represents an addendum to the human health risk screening levels (SLs) originally presented in the Multi-Site Risk Assessment Framework (RAF) for former manufactured gas plant sites (MGPs), prepared for Wisconsin Public Service Corporation, The Peoples Gas Light and Coke Company, and North Shore Gas Company (Exponent 2007). Elements of this addendum supersede and replace those presented in the original RAF (Exponent 2007) and the 2011 RAF Addendum (Exponent 2011). The human health SLs have been updated to incorporate the regional screening levels (RSLs; U.S. EPA 2013a) that the U.S. Environmental Protection Agency (EPA) developed after the RAF was approved. The EPA RSLs have become the standard screening levels for the initial screening step in human health risk assessments, and are now typically updated every six months. In addition, vapor intrusion (VI) SLs, which were not presented in the RAF, are incorporated in this addendum. The VI SLs are based on the RSLs and were calculated using the most recent Vapor Intrusion Screening Level (VISL) Calculator developed by EPA (U.S. EPA 2013b). Use of the RSLs and elements of this addendum were discussed in a technical exchange meeting between EPA and Integrys Business Support, LLC, and their respective consultants, on December 17, 2010. This RAF Addendum (Revision 2) addresses EPA comments on the RAF Addendum (Revision 1) dated April 22, 2013, and August 26, 2013 (U.S. EPA 2013c,d) and comments provided to EPA by Illinois EPA (IEPA 2013a,b).

This addendum also reflects changes in state (Illinois or Wisconsin) risk-based screening levels issued since the RAF Addendum (Revision 1) was developed in 2013. A separate list of SLs is provided for Wisconsin and Illinois sites to reflect the differences between the States' regulations.

SLs for MGP-related constituents of potential concern (COPCs), presented in Table 1 of the RAF, are summarized by medium within this document. On a site-specific basis, if other non-MGP-related analytes require consideration, human health SLs will be developed for those analytes using the processes specified in this addendum.

The human health SLs will be updated as the sources presented in this document are updated (e.g., when new versions of RSLs or the VISL calculator become available), or if, in the future, new sources of SLs become available. As appropriate, an update to this document will be provided shortly after an update to one or more sources of SLs.

Hierarchy Used to Develop Human Health Screening Levels

Human health SLs are provided for soil, groundwater, and VI-related media (i.e., indoor air, soil gas, and groundwater) in this addendum. A hierarchical approach was used to select human health SLs by analyte within each medium. When an SL is available from the highest tier source, values from lower tier sources are not used.

Hierarchy for All Media other than Directly Contacted Groundwater—The RSL values are used as the first-tier source of SLs for soil and indoor air, and as the basis for the VI–related SLs (i.e., soil gas and groundwater) that are calculated using the VISL calculator. For Illinois sites, State risk-based screening criteria are used as a second-tier (and sometimes third-tier) source of SLs to fill gaps where RSLs are not available. For Wisconsin sites, the State has transitioned to using RSLs as the basis of screening criteria for soil and VI–related media (indoor air and soil gas), as discussed further below; therefore, no second-tier screening criteria are used for soil or VI–related media.

Hierarchy for Directly Contacted Groundwater —For the groundwater direct-contact SLs, the site groundwater data will be compared separately to the tapwater RSLs, the federal maximum contaminant levels ([MCLs], U.S. EPA 2009), and State-promulgated drinking-water standards. As discussed in Section 5.2 of the RAF, these comparisons will be done to assess the potential risk if groundwater were to be used as a drinking-water source. The groundwater screening evaluation will be used in the baseline risk assessment only to determine whether concentrations of groundwater contaminants occur at levels that present a potential risk. The results of the groundwater screening will be documented in the risk assessment, but the risk assessment for this medium will not proceed beyond this screening step, because groundwater is not used as a drinking-water source at any of these sites. It is anticipated that the potential risk associated with groundwater will be assessed in the feasibility study, and if potential risks are present, they may be mitigated using risk management tools and/or remediation.

Media-Specific Human Health Screening Levels

The methods used to develop and select the SLs by medium are presented in this section.

Soil Screening Levels

Soil SLs were selected separately for residential and industrial/commercial land use. For simplicity, the industrial/commercial SLs are labeled as "industrial" SLs within this document and in the associated tables. The soil SLs for Integrys sites located in Wisconsin are presented in Tables 1 and 2, and the soil SLs for Integrys sites located in Illinois are presented in Tables 3 and 4. Due to recent changes described herein, many of the sources of soil SLs are the same for both states. However, separate tables will be maintained to accommodate the small number of differences that exist between the two states in analyte-specific SLs.

Integrys Sites in Wisconsin

The soil SLs to be used at Integrys sites in Wisconsin are presented in Table 1 (residential) and Table 2 (industrial). In 2013, the Wisconsin Department of Natural Resources (WDNR) published a guidance document that recommended determining state-specific soil residual contaminant levels using the EPA RSL web calculator (WDNR 2013a). This Wisconsin guidance recommends using EPA-provided default inputs for residential and industrial scenarios to estimate soil SLs, with the exception of the climatic zone. The climatic zone specified by the WDNR guidance is the Chicago zone. Because the default climatic zone used by EPA in

developing the RSLs will produce concentrations that are slightly lower in some cases than the Wisconsin recommended zone (Chicago), for conservativeness, this Addendum will adopt the default RSLs for Integrys sites in Wisconsin. On a site-specific basis, region-specific SLs may be used. In these cases, the regional adjustments will be documented in the site-specific risk assessment, Site-Specific Work Plan (SSWP), or other relevant document.

For arsenic in Wisconsin soils, Wisconsin has developed a background threshold value (BTV) of 8 mg/kg based on extensive sampling by the U.S. Geological Survey (WDNR 2013b). Based on the direction provided in NR 720 and comments provided through EPA, this BTV will be used as the soil SL for Integrys sites in Wisconsin (WDNR 2013c; U.S. EPA 2013c). The site-specific risk assessments will note that the BTV is higher than the risk-based values calculated for the RSLs (e.g., 0.61 mg/kg for residential and 2.4 mg/kg for industrial).

The RSLs for each analyte are developed based on a target cancer risk of one in one million (1×10^{-6}) for carcinogenic chemicals, or a target hazard quotient of one (1) for chemicals that elicit only noncancer effects (e.g., liver toxicity). Conservative default exposure assumptions that reflect either residential exposure or industrial worker exposure to soil are used, along with the target risk factors and toxicity values, to estimate the RSLs. When a chemical has the potential to cause cancer and noncancer toxicity effects, the lower of the two endpoint-specific values is used as the RSL. Additionally, if a risk-based concentration exceeds either the soil saturation concentration (Csat) or the ceiling limit of 100,000 mg/kg, the appropriate value will replace the risk-based concentration as the SL. Note that, while this approach will be used for the purpose of selecting the screening levels for determining whether a constituent is selected as a COPC for further evaluation in the baseline risk assessment, the risks estimated for the COPCs in the risk assessment will be based on the most current toxicity value available, as reflected in the RSL documentation.

For chromium and mercury, the RSL for the form most likely to be found at MGP sites was selected. Specifically, for chromium, the form present in soil depends on specific soil properties (e.g., eh, pH, mineralogy). In most soils, chromium is present predominantly as trivalent chromium (Cr^{3+}) (ATSDR 2012). Chromium may have been present at trace concentrations in MGP feedstock (i.e., coal or crude oil) at any MGP site (GRI 1996). However, combustion of these feedstocks results in emissions that contain only a small percentage (0.2%) of hexavalent chromium (Cr^{6+}) (ATSDR 2012). Thus, the RSL for Cr^{3+} was used as the SL. Mercury is a naturally occurring element that is usually found as mercuric sulfide (cinnabar), an insoluble, stable mercury salt, rather than as elemental mercury (ATSDR 1999). Because the most common form of mercury is mercuric sulfide, the RSL for mercury salts such as mercury sulfide is selected as the most appropriate RSL for mercury at MGP sites.

Integrys Sites in Illinois

The soil SLs for Illinois sites are presented in Tables 3 and 4. The first tier of the soil screening hierarchy for Illinois sites relies on the RSLs as described for Wisconsin sites. When an RSL was not available, a tiered approach to corrective action objectives (TACO) soil criterion developed by the Illinois Environmental Protection Agency (IEPA) was used. The most current promulgated TACO values were used (IEPA 2013c). TACO criteria are developed for residential, commercial workers, and construction workers. However, construction-worker

TACO values were not used in the hierarchy, because they were derived using exposure assumptions very different from those used to derive commercial TACO and industrial RSL screening values. The lowest of the available residential TACO criteria (ingestion or inhalation routes) were used as the residential SL when an RSL was not available. The lowest of the available commercial-worker TACO criteria (ingestion or inhalation routes) were used as the SLs for workers when an industrial RSL was not available.

If neither an RSL nor a TACO value was available, then a non-TACO value was used as the Illinois SL, if available. Non-TACO values are developed by IEPA using provisional toxicity values, but are not promulgated soil standards within Illinois. The most current non-TACO values available were used (October 30, 2012; IEPA 2012). The selection of residential and commercial/industrial non-TACO values followed the same scheme as that developed for TACO values (i.e., the lowest of available residential or commercial/industrial values was used).

For arsenic in Illinois soils, TACO recommends using a background concentration rather than a risk-based value. Thus, in Tables 3 and 4, the SLs presented for arsenic are the background concentration for counties within the metropolitan statistical areas (13.0 mg/kg) and the background concentration for counties outside the metropolitan statistical areas (11.3 mg/kg) (IEPA 2013c, Appendix A, Table G). The site-specific risk assessments will note that the Illinois background soil concentrations presented above are higher than the risk-based values calculated for the RSLs (i.e., 0.61 mg/kg for residential RSL and 2.4 mg/kg for industrial RSL). Additionally, on a site-specific basis, it may be appropriate to use background concentrations for selected polycyclic aromatic hydrocarbons (PAHs) in soils as another point of comparison in addition to the RSLs, because some of the PAH RSLs are below levels for the City of Chicago (IEPA 2013c, Appendix A, Table H). Such instances would be documented in the site-specific risk assessment and would be compared to both the soil RSL and the soil background criteria.

Groundwater Screening Levels

For screening groundwater at Integrys MGP sites within either Wisconsin or Illinois, the process will entail doing separate comparisons for each of three SLs: the tapwater RSL, the federal drinking-water standard (i.e., MCL [U.S. EPA 2009]), and the State-specific groundwater standard.

For Wisconsin sites, the state-specific regulation is the Wisconsin NR 140 Enforcement Standard (WDNR 2012a). For Illinois sites, the first tier of state-specific regulations is the Illinois Groundwater Quality Standards (IEPA 2013d). For Illinois sites, the TACO groundwater remediation objectives will be used as a second tier for any analyte not listed in the groundwater quality standards, and the non-TACO groundwater remediation objective will be used as a third tier (IEPA 2012). The groundwater SLs and their sources are summarized by state in Tables 5 and 6.

Indoor Air Screening Levels

Indoor air SLs were selected separately for residential and industrial land use. Indoor air RSLs were used as the indoor air SLs for both Wisconsin and Illinois sites. These indoor air SLs will

be used for indoor air investigations where the potential for vapor intrusion into a building exists based on subsurface soil or groundwater contamination associated with former MGP-related operations. The indoor air RSLs are summarized in Tables 7 and 8 for both residential and industrial properties. The EPA indoor air RSLs are used for both Wisconsin and Illinois MGP sites, because at this time, Illinois has no promulgated indoor air risk-based screening values, and Wisconsin adopted the indoor air RSLs as their source of risk-based indoor air screening values in their VI guidance (WDNR 2012b).

Vapor Intrusion Screening Levels for Soil Gas and Groundwater

For evaluating the vapor intrusion pathway, results from soil gas samples collected below a building (i.e., sub-slab) and/or collected external to a building will be compared to the appropriate screening levels described below. For external samples collected outside a building in areas not covered by asphalt or concrete, efforts will be made to collect these samples from at least 5 ft below ground surface, so that the potential for introducing ambient air into the soil gas sample is minimized. If site-specific circumstances necessitate the collection of soil gas samples at depths of less than 5 ft (e.g., shallow depth of the water table), the data collected in this manner will be evaluated separately in the risk assessment rather than being dismissed. The reason for the shallow depth of the samples, and uncertainty associated with these shallower-than-ideal samples, will be clearly noted. The EPA-approved standard operating procedure (SOP) for soil gas sampling for the Multi-Site Program (SOP SAS-11-06) states that probes will be installed no shallower than 2 feet below ground surface.

The VI SLs for soil gas and groundwater were calculated using the most current version of the VISL calculator developed by EPA (VISL-Calculator.xlsm, version 3.2, December 2013). The methods used by EPA to calculate the VI SLs are documented in the VISL User's Guide (U.S. EPA 2013b). The toxicity values used in the VISL calculator are updated by EPA each time they update the RSLs.

The VISL calculator estimates the VI SL for each analyte by using the indoor air RSLs (residential or industrial) as a target air concentration, combined with a medium-specific (i.e., soil gas or groundwater)-to-building attenuation factor, plus an additional chemical-specific factor (Henry's Law constant) for groundwater.

The VI SLs for soil gas and groundwater (based on a groundwater temperature of 25°C) are presented in Tables 7 and 8. Only VI SLs for compounds that are both sufficiently volatile and have an inhalation toxicity value are summarized in these tables. Those compounds considered sufficiently volatile were determined based on their categorization in the RSL table as "volatile." The two criteria used to determine whether an analyte is volatile are the chemical's molecular weight and its Henry's Law constant, as discussed in more detail in the RSL documentation and VISL guide. Both parameters are presented in the RSL documentation. The presence or absence of an inhalation toxicity value was also determined using the toxicity information presented in the RSL documentation. The VISL calculator automatically determines which analytes are both sufficiently volatile and have an inhalation toxicity value.

The attenuation factors listed below are currently used by the VISL calculator for derivation of the soil gas and groundwater VI SLs.

- Soil Gas 0.1
- Groundwater 0.001

These attenuation factors are currently under review by EPA headquarters, but are presently recommended as "conservative 'generic' attenuation factors that reflect generally reasonable worst-case conditions" for purposes of developing the initial VI SLs (U.S. EPA 2013b).

If, on a site-specific basis, other less conservative attenuation factors appear appropriate, they will be used to update the initial VI screening analysis. One such possible site-specific instance might be when evaluating VI for a large building for which specific criteria are met (e.g., increased size of building, thickness of floor, and greater air exchange rate). In such a situation, an alternative set of attenuation factors might be incorporated if site-specific building characteristics can justify the use of less conservative (i.e., lower) attenuation factors. For example, WDNR has incorporated this flexibility in their current approach within the VI guidance (WDNR 2012b) for large commercial buildings where the building factors listed above (e.g., building size) are documented and can be used to substantiate the use of lower attenuation factors. In the case of the Wisconsin VI guidance, an attenuation factor 10-fold lower than the default value is applied to address the increased attenuation that occurs within larger buildings. Such alternative VI evaluations will be communicated to EPA on a site-specific basis, and the justification for their application will be documented in the remedial investigation work plan or other relevant document.

Soil gas SLs are calculated by the VISL calculator using the following equation:

$$\text{Soil gas VI SL } (\mu g/m^3) = \frac{\text{Indoor air RSL } (\mu g/m^3)}{\text{Soil gas attenuation factor (dimensionless)}}$$

Groundwater VI SLs are calculated by the VISL calculator using the following equation:

$$\text{Groundwater VI SL } (\mu g/L) = \text{Indoor air RSL } (\mu g/m^3) \times \frac{1}{\text{Groundwater attenuation factor}} \times \frac{1}{\text{Henry's Law constant (dimensionless)}} \times 0.001\ m^3/L$$

The groundwater VI SLs are generated by the VISL calculator assuming a default average groundwater temperature of 25 °C. This default value results in conservatively high groundwater VI SLs, because groundwater temperature is typically lower than 25 °C, and the volatility of a chemical from groundwater decreases as the groundwater temperature decreases. The VISL calculator allows the user to adjust the average temperature of the groundwater to a site-specific value. For this reason, the groundwater data will be reviewed on a site-specific basis, and if appropriate, an average groundwater temperature value will be derived and used in the VISL calculator to develop a site-specific set of groundwater VI SLs.

The VI SLs presented herein are based on a default target cancer risk of 1×10^{-6} and noncancer hazard quotient of 1 (Tables 7 and 8). For those analytes that can cause both carcinogenic and

noncancer effects (e.g., benzene), the lower of the cancer- and noncancer-based SLs are presented in the screening tables.

Other conventions used by the VISL calculator are as follows:

- If the calculated VI soil gas SL exceeds its maximum chemical vapor-phase concentration, then the calculator yields NVT (not sufficiently volatile and/or toxic to pose inhalation risk)
- If the calculated groundwater VI SL exceeds the solubility for the pure chemical, then the calculator yields NVT (not sufficiently volatile and/or toxic to pose inhalation risk).

Cumulative Risk Check for Noncancer Effects

The SLs presented in this addendum for soil, indoor air, soil gas, and vapor migration from groundwater will be used as the first step in the human health screening process within the baseline risk assessment.[1] For each analyte, the maximum observed concentration will be compared to the SL to determine whether it should be carried forward into the baseline risk assessment as a COPC for further evaluation.

For noncarcinogens, an additional check will be performed to determine whether exposure to the multiple chemicals identified at the site will result in exceedance of the cumulative noncancer risk target (i.e., a hazard index of one). The process to perform this check is depicted in Figure 1.

To perform the check, the maximum concentration of each noncarcinogenic chemical detected at the site will be divided by its medium-specific SL, and then these individual ratios (i.e., hazard quotients) will be summed across all non-carcinogens detected at the site. If the sum of the hazard quotients results in a hazard index exceeding the value of 1, then those chemicals responsible for the exceedance will be carried forward for further evaluation within the baseline risk assessment, as described in Figure 1.

[1] Formal risk calculations for direct contact with groundwater will not be performed in the baseline risk assessment, because groundwater is not used as drinking water at any of these sites, so the special conditions discussed in this section do not apply for this exposure pathway.

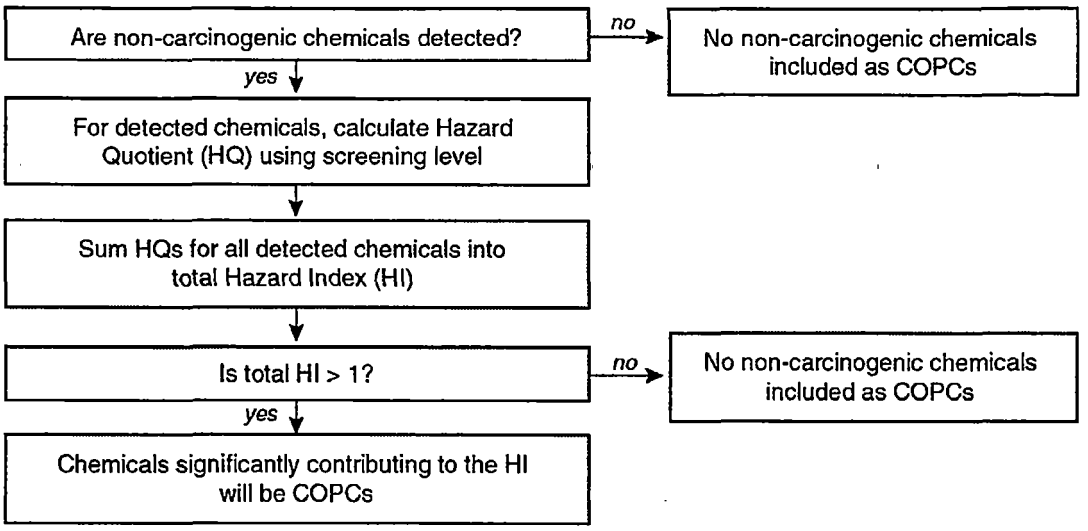

Figure 1. Screening check for cumulative non-carcinogenic effects

Construction-Worker Evaluation

Currently, EPA does not have construction-worker-specific screening levels to address potential risks to this receptor group. Typically, construction-worker exposures at a Site are shorter in duration than residential and industrial workers' exposures, so SLs that are considered protective of residential or industrial workers are in most cases thought to conservatively reflect concentration limits that would be protective of construction workers as well. However, in certain site-specific circumstances, construction workers may be exposed to certain media (e.g., NAPL, chemical vapors or soil gas, and groundwater) that are not reflected by the exposure pathways evaluated for developing residential or industrial worker SLs. For example, a construction worker may dig into the soils and perform work in an excavation that could potentially expose them to soil, groundwater, and chemical vapors in different ways from those assumed for the residential and industrial worker RSLs. In these instances, the residential or industrial-worker SLs may not reflect concentration limits that would be protective of construction workers. For Integrys MGP sites, the potential risks to future construction workers will be evaluated on a site-specific basis considering the environmental conditions at each MGP Site and the likely future land use.

The type of risk evaluation that may be performed for a potential future construction-worker population (i.e., qualitative, semi-quantitative, or fully-quantitative) at an Integrys MGP site will depend on site-specific circumstances. The selection of the construction worker risk evaluation option will be based on review of all the site-specific data available, and will be documented in the site-specific work plan and in the baseline risk assessment.

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Table 1. Residential soil screening levels for Integrys sites in Wisconsin

Analyte	CAS #	Selected Concentration Soil Residential (mg/kg)	Source	Comments for Selected Value	U.S. EPA (2013a) RSL Soil Residential (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	83-32-9	3,400 n	RSL		3,400 n	--
Acenaphthylene	208-96-8	3,400 n	RSL	Used surrogate of acenaphthene (83-32-9)	3,400 n	--
Anthracene	120-12-7	17,000 n	RSL		17,000 n	--
Benzo[a]anthracene	56-55-3	0.15 c	RSL		0.15 c	--
Benzo[a]pyrene	50-32-8	0.015 c	RSL		0.015 c	--
Benzo[b]fluoranthene	205-99-2	0.15 c	RSL		0.15 c	--
Benzo[g,h,i]perylene	191-24-2	1,700 n	RSL	Used surrogate of pyrene (129-00-0)	1,700 n	--
Benzo[k]fluoranthene	207-08-9	1.5 c	RSL		1.5 c	--
Chrysene	218-01-9	15 c	RSL		15 c	--
Dibenz[a,h]anthracene	53-70-3	0.015 c	RSL		0.015 c	--
Fluoranthene	206-44-0	2,300 n	RSL		2,300 n	--
Fluorene	86-73-7	2,300 n	RSL		2,300 n	--
Indeno[1,2,3-cd]pyrene	193-39-5	0.15 c	RSL		0.15 c	--
2-Methylnaphthalene	91-57-6	230 n	RSL		230 n	--
Naphthalene	91-20-3	3.6 c*	RSL		3.6 c*	--
Phenanthrene	85-01-8	17,000 n	RSL	Used surrogate of anthracene (120-12-7)	17,000 n	--
Pyrene	129-00-0	1,700 n	RSL		1,700 n	--
Phenols						
2,4-Dimethylphenol	105-67-9	1,200 n	RSL		1,200 n	--
2-Methylphenol (o-Cresol)	95-48-7	3,100 n	RSL		3,100 n	--
3&4-Methylphenol (m&p)	108-39-4	3,100 n	RSL	Used value for m-cresol (108-39-4)	3,100 n	--
Phenol	108-95-2	18,000 n	RSL		18,000 n	--
Volatile Organic Compounds						
Benzene	71-43-2	1.1 c*	RSL		1.1 c*	1,820
Ethylbenzene	100-41-4	5.4 c	RSL		5.4 c	480
Toluene	108-88-3	818 n	sat		5,000 ns	818
1,2,4-Trimethylbenzene	95-63-6	62 n	RSL		62 n	219
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		780 ns	182
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	590 ns	388
o-Xylene	95-47-6	434 n	sat		690 ns	434
Xylene (total)	1330-20-7	258 n	sat		630 ns	258
Metals and Inorganics						
Aluminum	7429-90-5	77,000 n	RSL		77,000 n	--
Antimony	7440-36-0	31 n	RSL	Antimony (metallic)	31 n	--
Arsenic	7440-38-2	8.0	background[1]	Arsenic, inorganic	0.61 c*	--
Barium	7440-39-3	15,000 n	RSL		15,000 n	--
Cadmium	7440-43-9	70 n	RSL	Dietary value	70 n	--
Chromium	7440-47-3	100,000 n	max	Used value for Cr(III)	120,000 nm	--
Copper	7440-50-8	3,100 n	RSL		3,100 n	--
Iron	7439-89-6	55,000 n	RSL		55,000 n	--
Lead	7439-92-1	400 n	RSL	Lead and compounds	400 n	--
Manganese	7439-96-5	1,800 n	RSL	Used non-dietary value	1,800 n	--
Mercury	7487-94-7	23 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	23 n	--
Nickel	7440-02-0	1,500 n	RSL	Nickel soluble salts	1,500 n	--
Selenium	7782-49-2	390 n	RSL		390 n	--
Silver	7440-22-4	390 n	RSL		390 n	--
Vanadium	7440-62-2	390 n	RSL	Vanadium and compounds	390 n	--
Zinc	7440-66-6	23,000 n	RSL	Zinc (metallic)	23,000 n	--
Cyanide	57-12-5	78 n	RSL	Used sodium cyanide (143-33-9)	78 n	--

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level.

For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at Integrys MGP sites. The source of the selected screening value is presented to the right of the numerical value.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2013 (U.S. EPA 2013a) (http://www.epa.gov/region9/superfund/prg.

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
m – concentration may exceed ceiling limit
max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
s – concentration may exceed C_{sat} (soil saturation concentration)
sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.

[1] Concentration is the background threshold value (BTV) for Wisconsin, determined by Wisconsin Department of Natural Resources (WDNR 2013b).

Table 2. Industrial soil screening levels for Integrys sites in Wisconsin

Analyte	CAS #	Selected Concentration Soil Industrial (mg/kg)	Source	Comments for Selected Value	U.S. EPA (2013a) RSL Soil Industrial (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	83-32-9	33,000 n	RSL		33,000 n	--
Acenaphthylene	208-96-8	33,000 n	RSL	Used surrogate of acenaphthene (83-32-9)	33,000 n	--
Anthracene	120-12-7	100,000 n	max		170,000 nm	--
Benzo[a]anthracene	56-55-3	2.1 c	RSL		2.1 c	--
Benzo[a]pyrene	50-32-8	0.21 c	RSL		0.21 c	--
Benzo[b]fluoranthene	205-99-2	2.1 c	RSL		2.1 c	--
Benzo[g,h,i]perylene	191-24-2	17,000 n	RSL	Used surrogate of pyrene (129-00-0)	17,000 n	--
Benzo[k]fluoranthene	207-08-9	21 c	RSL		21 c	--
Chrysene	218-01-9	210 c	RSL		210 c	--
Dibenz[a,h]anthracene	53-70-3	0.21 c	RSL		0.21 c	--
Fluoranthene	206-44-0	22,000 n	RSL		22,000 n	--
Fluorene	86-73-7	22,000 n	RSL		22,000 n	--
Indeno[1,2,3-cd]pyrene	193-39-5	2.1 c	RSL		2.1 c	--
2-Methylnaphthalene	91-57-6	2,200 n	RSL		2,200 n	--
Naphthalene	91-20-3	18 c*	RSL		18 c*	--
Phenanthrene	85-01-8	100,000 n	max	Used surrogate of anthracene (120-12-7)	170,000 nm	--
Pyrene	129-00-0	17,000 n	RSL		17,000 n	--
Phenols						
2,4-Dimethylphenol	105-67-9	12,000 n	RSL		12,000 n	--
2-Methylphenol (o-Cresol)	95-48-7	31,000 n	RSL		31,000 n	--
3&4-Methylphenol (m&p)	108-39-4	31,000 n	RSL	Used value for m-cresol (108-39-4)	31,000 n	--
Phenol	108-95-2	100,000 n	max		180,000 nm	--
Volatile Organic Compounds						
Benzene	71-43-2	5.4 c*	RSL		5.4 c*	1,820
Ethylbenzene	100-41-4	27 c	RSL		27 c	480
Toluene	108-88-3	818 n	sat		45,000 ns	818
1,2,4-Trimethylbenzene	95-63-6	219 n	sat		260 ns	219
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		10,000 ns	182
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	2,500 ns	388
o-Xylene	95-47-6	434 n	sat		3,000 ns	434
Xylene (total)	1330-20-7	258 n	sat		2,700 ns	258
Metals and Inorganics						
Aluminum	7429-90-5	100,000 n	max		990,000 nm	--
Antimony	7440-36-0	410 n	RSL	Antimony (metallic)	410 n	--
Arsenic	7440-38-2	8.0	background[1]	Arsenic, inorganic	2.4 c	--
Barium	7440-39-3	100,000 n	max		190,000 nm	--
Cadmium	7440-43-9	800 n	RSL	Dietary value	800 n	--
Chromium	7440-47-3	100,000 n	max	Used value for Cr(III)	1,500,000 nm	--
Copper	7440-50-8	41,000 n	RSL		41,000 n	--
Iron	7439-89-6	100,000 n	max		720,000 nm	--
Lead	7439-92-1	800 n	RSL	Lead and compounds	800 n	--
Manganese	7439-96-5	23,000 n	RSL	Used non-dietary value	23,000 n	--
Mercury	7487-94-7	310 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	310 n	--
Nickel	7440-02-0	20,000 n	RSL	Nickel soluble salts	20,000 n	--
Selenium	7782-49-2	5,100 n	RSL		5,100 n	--
Silver	7440-22-4	5,100 n	RSL		5,100 n	--
Vanadium	7440-62-2	5,100 n	RSL	Vanadium and compounds	5,100 n	--
Zinc	7440-66-6	100,000 n	max	Zinc (metallic)	310,000 nm	--
Cyanide	57-12-5	1,000 n	RSL	Used sodium cyanide (143-33-9)	1,000 n	--

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level.

For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at Integrys MGP sites. The source of the selected screening value is presented to the right of the numerical value.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2013 (U.S. EPA 2013a) (http://www.epa.gov/region9/superfund/prg/

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
m – concentration may exceed ceiling limit
max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
s – concentration may exceed C_{sat} (soil saturation concentration)
sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.

[1] Concentration is the background threshold value (BTV) for Wisconsin, determined by Wisconsin Department of Natural Resources (WDNR 2013b).

Table 3. Residential soil screening levels for Integrys sites in Illinois

Analyte	CAS #	Selected Concentration Soil Residential (mg/kg)	Source	Comments for Selected Value	U.S. EPA (2013a) RSL Soil Residential (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Residential Ingestion (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Residential Inhalation (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Residential Ingestion (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Residential Inhalation (mg/kg)
Semivolatile Organic Compounds										
Polycyclic Aromatic Hydrocarbons										
Acenaphthene	83-32-9	3,400 n	RSL		3,400 n	--	4,700 n	--	--	--
Acenaphthylene	208-96-8	3,400 n	RSL	Used surrogate of acenaphthene (83-32-9)	3,400 n	--	--	--	2,300 n	--
Anthracene	120-12-7	17,000 n	RSL		17,000 n	--	23,000 n	--	--	--
Benzo[a]anthracene	56-55-3	0.15 c	RSL		0.15 c	--	0.9 c,w	--	--	--
Benzo[a]pyrene	50-32-8	0.015 c	RSL		0.015 c	--	0.09 c,w	--	--	--
Benzo[b]fluoranthene	205-99-2	0.15 c	RSL		0.15 c	--	0.9 c,w	--	--	--
Benzo[g,h,i]perylene	191-24-2	1,700 n	RSL	Used surrogate of pyrene (129-00-0)	1,700 n	--	--	--	2,300 n	--
Benzo[k]fluoranthene	207-08-9	1.5 c	RSL		1.5 c	--	9 c	--	--	--
Chrysene	218-01-9	15 c	RSL		15 c	--	88 c	--	--	--
Dibenz[a,h]anthracene	53-70-3	0.015 c	RSL		0.015 c	--	0.09 c,w	--	--	--
Fluoranthene	206-44-0	2,300 n	RSL		2,300 n	--	3,100 n	--	--	--
Fluorene	86-73-7	2,300 n	RSL		2,300 n	--	3,100 n	--	--	--
Indeno[1,2,3-cd]pyrene	193-39-5	0.15 c	RSL		0.15 c	--	0.9 c,w	--	--	--
2-Methylnaphthalene	91-57-6	230 n	RSL		230 n	--	--	--	310 n	--
Naphthalene	91-20-3	3.6 c*	RSL		3.6 c*	--	1,600 n	170 n	--	--
Phenanthrene	85-01-8	17,000 n	RSL	Used surrogate of anthracene (120-12-7)	17,000 n	--	--	--	2,300 n	--
Pyrene	129-00-0	1,700 n	RSL		1,700 n	--	2,300 n	--	--	--
Phenols										
2,4-Dimethylphenol	105-67-9	1,200 n	RSL		1,200 n	--	1,600 n	--	--	--
2-Methylphenol (o-Cresol)	95-48-7	3,100 n	RSL		3,100 n	--	3,900 n	--	--	--
3&4-Methylphenol (m&p)	108-39-4	3,100 n	RSL	Used value for m-cresol (108-39-4)	3,100 n	--	--	--	3,900 n	8,100 d
Phenol	108-95-2	18,000 n	RSL		18,000 n	--	23,000 n	--	--	--
Volatile Organic Compounds										
Benzene	71-43-2	1.1 c*	RSL		1.1 c*	1,820	12 c	0.8 c	--	--
Ethylbenzene	100-41-4	5.4 c	RSL		5.4 c	480	7,800 n	400 d	--	--
Toluene	108-88-3	818 n	sat		5,000 ns	818	16,000 n	650 d	--	--
1,2,4-Trimethylbenzene	95-63-6	62 n	RSL		62 n	219	--	--	--	87 n
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		780 ns	182	--	--	780 n	--
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	590 ns	388	16,000 n	460 d	--	--
o-Xylene	95-47-6	434 n	sat		690 ns	434	16,000 n	410 d	--	--
Xylene (total)	1330-20-7	258 n	sat		630 ns	258	16,000 n	320 d	--	--
Metals and Inorganics										
Aluminum	7429-90-5	77,000 n	RSL		77,000 n	--	--	--	78,000 n	1,000,000 n
Antimony	7440-36-0	31 n	RSL	Antimony (metallic)	31 n	--	31 n	--	--	--
Arsenic	7440-38-2	13.0 / 11.3	background[1]	Arsenic, inorganic	0.61 c*	--	13.0 / 11.3 t	750 c	--	--
Barium	7440-39-3	15,000 n	RSL		15,000 n	--	5,500 n	690,000 n	--	--
Cadmium	7440-43-9	70 n	RSL	Dietary value	70 n	--	78 n	1,800 c	--	--
Chromium	7440-47-3	100,000 n	max	Used value for Cr(III)	120,000 nm	--	230 n	270 c	--	--
Copper	7440-50-8	3,100 n	RSL		3,100 n	--	2,900 n	--	--	--
Iron	7439-89-6	55,000 n	RSL		55,000 n	--	--	--	--	--
Lead	7439-92-1	400 n	RSL		400 n	--	400 n	--	--	--
Manganese	7439-96-5	1,800 n	RSL	Used non-dietary value	1,800 n	--	1,600 n,v	69,000 n	--	--
Mercury	7487-94-7	23 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	23 n	--	23 n	10 n	--	--
Nickel	7440-02-0	1,500 n	RSL	Nickel soluble salts	1,500 n	--	1,600 n	13,000 c	--	--
Selenium	7782-49-2	390 n	RSL		390 n	--	390 n	--	--	--
Silver	7440-22-4	390 n	RSL		390 n	--	390 n	--	--	--
Vanadium	7440-62-2	390 n	RSL	Vanadium and compounds	390 n	--	550 n	--	--	--
Zinc	7440-66-6	23,000 n	RSL	Zinc (metallic)	23,000 n	--	23,000 n	--	--	--
Cyanide	57-12-5	78 n	RSL	Used sodium cyanide (143-33-9)	78 n	--	1,600 n	--	--	--

(footnotes on following page)

Table 3. Residential soil screening levels for Integrys sites in Illinois

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at Integrys MGP sites. The source of the selected screening value is presented to the right of the numerical value.

Hierarchy for soil screening criteria:
RSL, then TACO, then non-TACO value.
For all TACO and non-TACO soil remediation objectives, the lowest of the two pathway-specific (i.e., ingestion or inhalation) values is used.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2013 (U.S. EPA 2013a) (http://www.epa.gov/region9/superfund/prg/)

TACO and non-TACO
Illinois Tiered Approach to Corrective Action Objectives (TACO), soil remediation objectives, Title 35 Part 742 (IEPA 2013c) (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO objectives (IEPA 2012) (http://www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html)

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- d – soil saturation concentration (C_{sat}) – the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached; above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.
- t – values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) from 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils];
- v – value based on reference dose adjusted for dietary intake
- w – for sites located in any populated area as defined in Section 742.200, Appendix A, Table H may be used [Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils]; see text for details

[1] Concentrations are the Illinois background concentrations for arsenic from TACO. Values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) are taken from IEPA 2013c, 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils].

Table 4. Industrial soil screening levels for Integrys sites in Illinois

Analyte	CAS #	Selected Concentration Soil Industrial (mg/kg)	Source	Comments for Selected Value	U.S. EPA (2013a) RSL Soil Industrial (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Industrial Ingestion (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Industrial Inhalation (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Industrial Ingestion (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Industrial Inhalation (mg/kg)
Semivolatile Organic Compounds										
Polycyclic Aromatic Hydrocarbons										
Acenaphthene	83-32-9	33,000 n	RSL		33,000 n	--	120,000 n	--	--	--
Acenaphthylene	208-96-8	33,000 n	RSL	Used surrogate of acenaphthene (83-32-9)	33,000 n	--	--	--	61,000 n	--
Anthracene	120-12-7	100,000 n	max		170,000 nm	--	610,000 n	--	--	--
Benzo[a]anthracene	56-55-3	2.1 c	RSL		2.1 c	--	8 c	--	--	--
Benzo[a]pyrene	50-32-8	0.21 c	RSL		0.21 c	--	0.8 c,w	--	--	--
Benzo[b]fluoranthene	205-99-2	2.1 c	RSL		2.1 c	--	8 c	--	--	--
Benzo[g,h,i]perylene	191-24-2	17,000 n	RSL	Used surrogate of pyrene (129-00-0)	17,000 n	--	--	--	61,000 n	--
Benzo[k]fluoranthene	*207-08-9*	*21 c*	RSL		*21 c*	--	*78 c*	--	--	--
Chrysene	218-01-9	210 c	RSL		210 c	--	780 c	--	--	--
Dibenz[a,h]anthracene	53-70-3	0.21 c	RSL		0.21 c	--	0.8 c	--	--	--
Fluoranthene	206-44-0	22,000 n	RSL		22,000 n	--	82,000 n	--	--	--
Fluorene	86-73-7	22,000 n	RSL		22,000 n	--	82,000 n	--	--	--
Indeno[1,2,3-cd]pyrene	193-39-5	2.1 c	RSL		2.1 c	--	8 c	--	--	--
2-Methylnaphthalene	91-57-6	2,200 n	RSL		2,200 n	--	--	--	8,200 n	--
Naphthalene	91-20-3	18 c*	RSL		18 c*	--	41,000 n	270 n	--	--
Phenanthrene	*85-01-8*	*100,000 n*	*max*	*Used surrogate of anthracene (120-12-7)*	*170,000 nm*	--	--	--	*61,000 n*	--
Pyrene	129-00-0	17,000 n	RSL		17,000 n	--	61,000 n	--	--	--
Phenols										
2,4-Dimethylphenol	105-67-9	12,000 n	RSL		12,000 n	--	41,000 n	--	--	--
2-Methylphenol (o-Cresol)	95-48-7	31,000 n	RSL		31,000 n	--	100,000 n	--	--	--
3&4-Methylphenol (m&p)	108-39-4	31,000 n	RSL	Used value for m-cresol (108-39-4)	31,000 n	--	--	--	100,000 n	8,100 d
Phenol	108-95-2	100,000 n	max		180,000 nm	--	610,000 n	--	--	--
Volatile Organic Compounds										
Benzene	71-43-2	5.4 c*	RSL		5.4 c*	1,820	100 c	1.6 c	--	--
Ethylbenzene	100-41-4	27 c	RSL		27 c	480	200,000 n	400 d	--	--
Toluene	108-88-3	818 n	sat		45,000 ns	818	410,000 n	650 d	--	--
1,2,4-Trimethylbenzene	95-63-6	219 n	sat		260 ns	219	--	--	--	140 n
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		10,000 ns	182	--	--	20,000 n	--
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	2,500 ns	388	410,000 n	460 d	--	--
o-Xylene	95-47-6	434 n	sat		3,000 ns	434	410,000 n	410 d	--	--
Xylene (total)	1330-20-7	258 n	sat		2,700 ns	258	410,000 n	320 d	--	--
Metals and Inorganics										
Aluminum	7429-90-5	100,000 n	max		990,000 nm	--	--	--	1,000,000 n	1,000,000 n
Antimony	7440-36-0	410 n	RSL	Antimony (metallic)	410 n	--	820 n	--	--	--
Arsenic	7440-38-2	13.0 / 11.3	background[1]	Arsenic, inorganic	2.4 c	--	13.0 / 11.3 t	1,200 c	--	--
Barium	7440-39-3	100,000 n	max		190,000 nm	--	140,000 n	910,000 n	--	--
Cadmium	7440-43-9	800 n	RSL	Dietary value	800 n	--	2,000 n	2,800 c	--	--
Chromium	7440-47-3	100,000 n	max	Cr(III) for soil	1,500,000 nm	--	6,100 n	420 c	--	--
Copper	7440-50-8	41,000 n	RSL		41,000 n	--	82,000 n	--	--	--
Iron	7439-89-6	100,000 n	max		720,000 nm	--	--	--	--	--
Lead	7439-92-1	800 n	RSL		800 n	--	800 n	--	--	--
Manganese	7439-96-5	23,000 n	RSL	Used non-dietary value	23,000 n	--	41,000 n,v	91,000 n	--	--
Mercury	7487-94-7	310 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	310 n	--	610 n	16 n	--	--
Nickel	7440-02-0	20,000 n	RSL	Nickel soluble salts	20,000 n	--	41,000 n	21,000 c	--	--
Selenium	7782-49-2	5,100 n	RSL		5,100 n	--	10,000 n	--	--	--
Silver	7440-22-4	5,100 n	RSL		5,100 n	--	10,000 n	--	--	--
Vanadium	7440-62-2	5,100 n	RSL	Vanadium and compounds	5,100 n	--	14,000 n	--	--	--
Zinc	7440-66-6	100,000 n	max	Zinc (metallic)	310,000 nm	--	610,000 n	--	--	--
Cyanide	57-12-5	1,000 n	RSL	Used sodium cyanide (143-33-9)	1,000 n	--	41,000 n	--	--	--

(footnotes on following page)

Table 4. Industrial soil screening levels for Integrys sites in Illinois

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at Integrys MGP sites. The source of the selected screening value is presented to the right of the numerical value.

Hierarchy for soil screening criteria:
RSL, then TACO, then non-TACO value.
For all TACO and non-TACO soil remediation objectives, the lowest of the two pathway-specific (i.e., ingestion or inhalation) values was used.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2013 (U.S. EPA 2013a) (http://www.epa.gov/region9/superfund/prg/)

TACO and non-TACO
Illinois Tiered Approach to Corrective Action Objectives (TACO), soil remediation objectives, Title 35 Part 742 (IEPA 2013c) (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO objectives (IEPA 2012) (http://www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html)

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- d – soil saturation concentration (C_{sat}) – the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached; above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.
- t – values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) from 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils];
- v – value based on reference dose adjusted for dietary intake
- w – for sites located in any populated area as defined in Section 742.200, Appendix A, Table H may be used [Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils]; see text for details

[1] Per the Illinois state guidance in TACO, the background concentration is used for comparison to site concentrations. Values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) are taken from IEPA 2013c, 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils].

Table 5. Groundwater screening levels for Integrys sites in Wisconsin

Analyte	CAS #	Screening Criteria: U.S. EPA (2013a) RSL Tapwater (µg/L)	Screening Criteria: U.S. EPA (2009) Maximum Contaminant Level (µg/L)	Screening Criteria: WDNR (2012a) NR140 Groundwater Enforcement Standard (µg/L)	Comments
Semivolatile Organic Compounds					
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	83-32-9	400 n	--	--	
Acenaphthylene	208-96-8	400 n	--	--	Used surrogate of acenaphthene (83-32-9)
Anthracene	120-12-7	1,300 n	--	3,000	
Benzo[a]anthracene	56-55-3	0.029 c	--	--	
Benzo[a]pyrene	50-32-8	0.0029 c	0.2	0.2	
Benzo[b]fluoranthene	205-99-2	0.029 c	--	0.2	
Benzo[g,h,i]perylene	191-24-2	87 n	--	--	Used surrogate of pyrene (129-00-0)
Benzo[k]fluoranthene	207-08-9	0.29 c	--	--	
Chrysene	218-01-9	2.9 c	--	0.2	
Dibenz[a,h]anthracene	53-70-3	0.0029 c	--	--	
Fluoranthene	206-44-0	630 n	--	400	
Fluorene	86-73-7	220 n	--	400	
Indeno[1,2,3-cd]pyrene	193-39-5	0.029 c	--	--	
2-Methylnaphthalene	91-57-6	27 n	--	--	
Naphthalene	91-20-3	0.14 c*	--	100	
Phenanthrene	85-01-8	1,300 n	--	--	Used surrogate of anthracene (120-12-7)
Pyrene	129-00-0	87 n	--	250	
Phenols					
2,4-Dimethylphenol	105-67-9	270 n	--	--	
3&4-Methylphenol (m&p)	108-39-4	720 n	--	--	Used value for m-cresol (108-39-4)
2-Methylphenol (o-Cresol)	95-48-7	720 n	--	--	
Phenol	108-95-2	4,500 n	--	2,000	
Volatile Organic Compounds					
Benzene	71-43-2	0.39 c*	5	5	
Ethylbenzene	100-41-4	1.3 c	700	700	
Toluene	108-88-3	860 n	1,000	800	
1,2,4-Trimethylbenzene	95-63-6	15 n	--	--	
1,3,5-Trimethylbenzene	108-67-8	87 n	--	--	
m&p-Xylene	108-38-3	190 n	--	--	Used value for m-xylene (108-38-3)
o-Xylene	95-47-6	190 n	--	--	
Xylene (total)	1330-20-7	190 n	10,000	2,000	
Metals and Inorganics					
Aluminum	7429-90-5	16,000 n	--	200	
Antimony	7440-36-0	6.0 n	6	6	
Arsenic	7440-38-2	0.045 c	10	10	
Barium	7440-39-3	2,900 n	2,000	2,000	
Cadmium	7440-43-9	6.9 n	5	5	
Chromium	7440-47-3	16,000 n	100	100	For MCL: Cr (total); For RSL: Cr(III)
Copper	7440-50-8	620 n	1,300	1,300	
Iron	7439-89-6	11,000 n	--	--	
Lead	7439-92-1	15	15	15	
Manganese	7439-96-5	320 n	--	300	
Mercury	7487-94-7	4.3 n	2	2	For RSL: mercuric chloride (& other Hg salts)
Nickel	7440-02-0	300 n	--	100	For RSL: nickel soluble salts
Selenium	7782-49-2	78 n	50	50	
Silver	7440-22-4	71 n	--	50	
Vanadium	7440-62-2	63 n	--	30	
Zinc	7440-66-6	4,700 n	--	--	
Cyanide	57-12-5	16 n	200	200	For RSL: sodium cyanide; For WI: cyanide, free

Notes: Site concentrations will be screened separately against all three sets of criteria. Any analyte exceeding any criteria will be considered a chemical of potential concern.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2013 (U.S. EPA 2013a) (http://www.epa.gov/region9/superfund/prg/)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

WI NR140: WI NR 140 groundwater quality enforcement standards published in Register 673, dated January 2012 (WDNR 2012a) (*http://docs.legis.wisconsin.gov/code/admin_code/nr/140.pdf*)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1

Table 6. Groundwater screening levels for Integrys sites in Illinois

Analyte	CAS #	Screening Criteria: U.S. EPA (2013a) RSL Tapwater (µg/L)	Screening Criteria: U.S. EPA (2009) Maximum Contaminant Level (µg/L)	Screening Criteria: Selected Illinois Groundwater Value[a] (µg/L)	IEPA (2013d) Illinois Groundwater Quality Standard Class I (µg/L)	IEPA (2013c) TACO Remediation Objective, Class I Groundwater (µg/L)	IEPA (2012) Non-TACO Remediation Objective, Class I Groundwater (µg/L)	Comments
Semivolatile Organic Compounds								
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	83-32-9	400 n	--	420 QS	420	420	--	
Acenaphthylene	208-96-8	400 n	--	210 non-TACO	--	--	210	Used surrogate of acenaphthene (83-32-9) for RSL
Anthracene	120-12-7	1,300 n	--	2,100 QS	2,100	2,100	--	
Benzo[a]anthracene	56-55-3	0.029 c	--	0.13 QS	0.13	0.13	--	
Benzo[a]pyrene	50-32-8	0.0029 c	0.2	0.2 QS	0.2	0.2	--	
Benzo[b]fluoranthene	205-99-2	0.029 c	--	0.18 QS	0.18	0.18	--	
Benzo[g,h,i]perylene	*191-24-2*	*87 n*	--	*210 non-TACO*	--	--	*210*	*Used surrogate of pyrene (129-00-0) for RSL*
Benzo[k]fluoranthene	207-08-9	0.29 c	--	0.17 QS	0.17	0.17	--	
Chrysene	218-01-9	2.9 c	--	12 QS	12	1.5	--	
Dibenz[a,h]anthracene	53-70-3	0.0029 c	--	0.3 QS	0.3	0.3	--	
Fluoranthene	206-44-0	630 n	--	280 QS	280	280	--	
Fluorene	86-73-7	220 n	--	280 QS	280	280	--	
Indeno[1,2,3-cd]pyrene	193-39-5	0.029 c	--	0.43 QS	0.43	0.43	--	
2-Methylnaphthalene	91-57-6	27 n	--	28 QS	28	--	28	
Naphthalene	91-20-3	0.14 c*	--	140 QS	140	140	--	
Phenanthrene	85-01-8	1,300 n	--	210 non-TACO	--	--	210	Used surrogate of anthracene (120-12-7) for RSL
Pyrene	129-00-0	87 n	--	210 QS	210	210	--	
Phenols								
2,4-Dimethylphenol	105-67-9	270 n	--	140 TACO	--	140	--	
2-Methylphenol (o-Cresol)	95-48-7	720 n	--	350 QS	350	350	--	
3&4-Methylphenol (m&p)	108-39-4	720 n	--	350 non-TACO	--	--	35	Used value for m-cresol (108-39-4)
Phenol	108-95-2	4,500 n	--	100 QS	100	100	--	
Volatile Organic Compounds								
Benzene	71-43-2	0.39 c*	5	5 QS	5	5	--	
Ethylbenzene	100-41-4	1.3 c	700	700 QS	700	700	--	
Toluene	108-88-3	860 n	1,000	1,000 QS	1,000	1,000	--	
1,2,4-Trimethylbenzene	95-63-6	15 n	--	--	--	--	--	
1,3,5-Trimethylbenzene	108-67-8	87 n	--	70 non-TACO	--	--	70	
m&p-Xylene	108-38-3	190 n	--	--	--	--	--	Used value for m-xylene (108-38-3) for RSL
o-Xylene	95-47-6	190 n	--	--	--	--	--	
Xylene (total)	1330-20-7	190 n	10,000	10,000 QS	10,000	10,000	--	
Metals and Inorganics								
Aluminum	7429-90-5	16,000 n	--	3,500 non-TACO	--	--	3,500	
Antimony	7440-36-0	6.0 n	6	6 QS	6	6	--	
Arsenic	7440-38-2	0.045 c	10	10 QS	10	50	--	
Barium	7440-39-3	2,900 n	2,000	2,000 QS	2,000	2,000	--	
Cadmium	7440-43-9	6.9 n	5	5 QS	5	5	--	
Chromium	7440-47-3	16,000 n	100	100 QS	100	100	--	For MCL: Cr (total); For RSL: Cr(III)
Copper	7440-50-8	620 n	1,300	650 QS	650	650	--	
Iron	7439-89-6	11,000 n	--	5,000 QS	5,000	5,000	--	
Lead	7439-92-1	15	15	7.5 QS	7.5	7.5	--	
Manganese	7439-96-5	320 n	--	150 QS	150	150	--	
Mercury	7487-94-7	4.3 n	2	2 QS	2	2	--	For RSL: mercuric chloride (& other Hg salts)
Nickel	7440-02-0	300 n	--	100 QS	100	100	--	For RSL: nickel soluble salts
Selenium	7782-49-2	78 n	50	50 QS	50	50	--	
Silver	7440-22-4	71 n	--	50 QS	50	50	--	
Vanadium	7440-62-2	63 n	--	49 QS	49	49	--	
Zinc	7440-66-6	4,700 n	--	5,000 QS	5,000	5,000	--	
Cyanide	57-12-5	16 n	200	200 QS	200	200	--	For RSL: sodium cyanide (143-33-9)

(footnotes on following page)

Table 6. Groundwater screening levels for Integrys sites in Illinois

Notes: Site concentrations will be screened separately against all three sets of criteria. Any analyte exceeding any criteria will be considered a chemical of potential concern.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2013 (U.S. EPA 2013a) (http://www.epa.gov/region9/superfund/prg/)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

Illinois standards or objectives

Illinois Groundwater Quality Standards for Class I: Potable Resource, Title 35 Part 620 (IEPA 2013d) (www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois Tiered Approach to Corrective Action Objectives (TACO), groundwater remediation objectives, Title 35 Part 742 (IEPA 2013c) (www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO objectives (IEPA 2012) (www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
non-TACO – value is the Illinois non-TACO objective
QS – value is the Illinois groundwater quality standard
TACO – value is the Illinois TACO groundwater remediation objective

[a] Hierarchy for selected Illinois groundwater screening criteria: Groundwater quality standard, then TACO remediation objective, then non-TACO remediation objective.

Table 7. Residential vapor intrusion screening levels for sites in Illinois and Wisconsin

Analyte	CAS #	Selected Risk-Based Concentrations, Residential: Indoor Air RSL ($\mu g/m^3$)	Soil Gas ($\mu g/m^3$)	Groundwater, Vapor Intrusion ($\mu g/L$)	Comments for Selected Value	U.S. EPA (2009) Maximum Contaminant Level ($\mu g/L$)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Naphthalene	91-20-3	0.072 c*	0.72 c	4.0 c		–
Volatile Organic Compounds						
Benzene	71-43-2	0.31 c	3.1 c	1.4 c	MCL is higher than groundwater VI value	5
Ethylbenzene	100-41-4	0.97 c	9.7 c	3.0 c	MCL is higher than groundwater VI value	700
Toluene	108-88-3	5,200 n	52,000 n	19,000 n		1,000
1,2,4-Trimethylbenzene	95-63-6	7.3 n	73 n	29 n		–
1,3,5-Trimethylbenzene	108-67-8	7.3 n	73 n	20 n	*Used RfC for 1,2,4-trimethylbenzene*	–
m&p-Xylene	108-38-3	100 n	1,000 n	360 n	Used value for m-xylene (108-38-3)	–
o-Xylene	95-47-6	100 n	1,000 n	490 n		–
Xylene (total)	1330-20-7	100 n	1,000 n	490 n	MCL is higher than groundwater VI value	10,000

Notes:

The vapor intrusion soil gas and groundwater screening values are based on the indoor air RSL, and derived using EPA's Vapor Instrusion Screening Level Calculator, Version 3.2 (updated using November 2013 RSLs, epa.gov/oswer/vaporintrusion/guidance.html).

The groundwater vapor intrusion values are based on a default groundwater temperature of 25°C. Only analytes that are sufficiently volatile and have available inhalation toxicity values are presented.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2013 (U.S. EPA 2013a) (http://www.epa.gov/region9/superfund/prg/)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
RfC – reference concentration
VI – vapor intrusion

Table 8. Industrial vapor intrusion screening levels for sites in Illinois and Wisconsin

Analyte	CAS #	Selected Risk-Based Concentrations, Industrial: Indoor Air RSL (µg/m³)	Soil Gas (µg/m³)	Groundwater, Vapor Intrusion (µg/L)	Comments for Selected Value	U.S. EPA (2009) Maximum Contaminant Level (µg/L)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Naphthalene	91-20-3	0.36 c*	3.6 c	20 c		–
Volatile Organic Compounds						
Benzene	71-43-2	1.6 c*	16 c	6.9 c		5
Ethylbenzene	100-41-4	4.9 c	49 c	15 c	MCL is higher than groundwater VI value	700
Toluene	108-88-3	22,000 n	220,000 n	81,000 n		1,000
1,2,4-Trimethylbenzene	95-63-6	31 n	310 n	120 n		–
1,3,5-Trimethylbenzene	108-67-8	31 n	310 n	86 n	Used RfC for 1,2,4-trimethylbenzene	–
m&p-Xylene	108-38-3	440 n	4,400 n	1,500 n	Used value for m-xylene (108-38-3)	–
o-Xylene	95-47-6	440 n	4,400 n	2,100 n		–
Xylene (total)	1330-20-7	440 n	4,400 n	2,100 n	MCL is higher than groundwater VI value	10,000

Notes:

The vapor intrusion soil gas and groundwater screening values are based on the indoor air RSL, and derived using EPA's Vapor Instrusion Screening Level Calculator, Version 3.2 (updated using November 2013 RSLs, epa.gov/oswer/vaporintrusion/guidance.html).

The groundwater vapor intrusion values are based on a default groundwater temperature of 25°C. Only analytes that are sufficiently volatile and have available inhalation toxicity values are presented.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2013 (U.S. EPA 2013a) (http://www.epa.gov/region9/superfund/prg/)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
RfC – reference concentration
VI – vapor intrusion

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Risk Assessment Framework Addendum (Revision 3)

This document represents an addendum to the human health risk screening levels (SLs) originally presented in the Multi-Site Risk Assessment Framework (RAF) for former manufactured gas plant sites (MGPs), prepared for Wisconsin Public Service Corporation, The Peoples Gas Light and Coke Company, and North Shore Gas Company (Exponent 2007). Elements of this addendum supersede and replace those presented in the original RAF (Exponent 2007) and the 2011 RAF Addendum (Exponent 2011), and update those provided in 2014 RAF Addendum, Revision 2 (Exponent 2014a). The human health SLs have been updated to incorporate the regional screening levels (RSLs; U.S. EPA 2014a) that the U.S. Environmental Protection Agency (EPA) developed after the RAF was approved. The EPA RSLs have become the standard screening levels for the initial screening step in human health risk assessments, and are now typically updated every six months. In addition, vapor intrusion (VI) SLs, which were not presented in the RAF, are incorporated in this addendum. The VI SLs are based on the RSLs and were calculated using the most recent Vapor Intrusion Screening Level (VISL) Calculator developed by EPA (U.S. EPA 2014b). Use of the RSLs and elements of this addendum were discussed in a technical exchange meeting between EPA and Integrys Business Support, LLC, and their respective consultants, on December 17, 2010. This RAF Addendum (Revision 3) updates the previous revision with the use of the most recent iteration of the RSLs. A separate list of SLs is provided for Wisconsin and Illinois sites to reflect the differences between the States' regulations.

SLs for MGP-related constituents of potential concern (COPCs), presented in Table 1 of the RAF, are summarized by medium within this document. On a site-specific basis, if other non-MGP-related analytes require consideration, human health SLs will be developed for those analytes using the processes specified in this addendum.

The human health SLs will be updated as the sources presented in this document are updated (e.g., when new versions of RSLs or the VISL calculator become available), or if, in the future, new sources of SLs become available. As appropriate, an update to this document will be provided shortly after an update to one or more sources of SLs.

Hierarchy Used to Develop Human Health Screening Levels

Human health SLs are provided for soil, groundwater, and VI-related media (i.e., indoor air, soil gas, and groundwater) in this addendum. A hierarchical approach was used to select human health SLs by analyte within each medium. When an SL is available from the highest tier source, values from lower tier sources are not used.

Hierarchy for All Media other than Directly Contacted Groundwater—The RSL values are used as the first-tier source of SLs for soil and indoor air, and as the basis for the VI–related SLs (i.e., soil gas and groundwater) that are calculated using the VISL calculator. For Illinois sites, State risk-based screening criteria are used as a second-tier (and sometimes third-tier) source of

SLs to fill gaps where RSLs are not available. For Wisconsin sites, the State has transitioned to using RSLs as the basis of screening criteria for soil and VI–related media (indoor air and soil gas), as discussed further below; therefore, no second-tier screening criteria are used for soil or VI–related media.

Hierarchy for Directly Contacted Groundwater —For the groundwater direct-contact SLs, the site groundwater data will be compared separately to the tapwater RSLs, the federal maximum contaminant levels ([MCLs], U.S. EPA 2009), and State-promulgated drinking-water standards. As discussed in Section 5.2 of the RAF, these comparisons will be done to assess the potential risk if groundwater were to be used as a drinking-water source. The groundwater screening evaluation will be used in the baseline risk assessment only to determine whether concentrations of groundwater contaminants occur at levels that present a potential risk. The results of the groundwater screening will be documented in the risk assessment, but the risk assessment for this medium will not proceed beyond this screening step, because groundwater is not used as a drinking-water source at any of these sites. It is anticipated that the potential risk associated with groundwater will be assessed in the feasibility study, and if potential risks are present, they may be mitigated using risk management tools and/or remediation.

Medium-Specific Human Health Screening Levels

The methods used to develop and select the SLs by medium are presented in this section.

Soil Screening Levels

Soil SLs were selected separately for residential and industrial/commercial land use. For simplicity, the industrial/commercial SLs are labeled as "industrial" SLs within this document and in the associated tables. The soil SLs for Integrys sites located in Wisconsin are presented in Tables 1 and 2, and the soil SLs for Integrys sites located in Illinois are presented in Tables 3 and 4. Due to recent changes described herein, many of the sources of soil SLs are the same for both states. However, separate tables will be maintained to accommodate the small number of differences that exist between the two states in analyte-specific SLs.

Integrys Sites in Wisconsin

The soil SLs to be used at Integrys sites in Wisconsin are presented in Table 1 (residential) and Table 2 (industrial). In 2013, the Wisconsin Department of Natural Resources (WDNR) published a guidance document that recommended determining state-specific soil residual contaminant levels using the EPA RSL web calculator (WDNR 2013a). This Wisconsin guidance recommends using EPA-provided default inputs for residential and industrial scenarios to estimate soil SLs, with the exception of the climatic zone. The climatic zone specified by the WDNR guidance is the Chicago zone. Because the default climatic zone used by EPA in developing the RSLs will produce concentrations that are slightly lower in some cases than the Wisconsin recommended zone (Chicago), for conservativeness, this Addendum will adopt the default RSLs for Integrys sites in Wisconsin. On a site-specific basis, region-specific SLs may

be used. In these cases, the regional adjustments will be documented in the site-specific risk assessment, Site-Specific Work Plan (SSWP), or other relevant document.

For arsenic in Wisconsin soils, Wisconsin has developed a background threshold value (BTV) of 8 mg/kg based on extensive sampling by the U.S. Geological Survey (WDNR 2013b). Based on the direction provided in NR 720 and comments provided through EPA, this BTV will be used as the soil SL for Integrys sites in Wisconsin (WDNR 2013c; U.S. EPA 2013c). The site-specific risk assessments will note that the BTV is higher than the risk-based values calculated for the RSLs (e.g., 0.61 mg/kg for residential and 2.4 mg/kg for industrial).

The RSLs for each analyte are developed based on a target cancer risk of one in one million (1×10^{-6}) for carcinogenic chemicals, or a target hazard quotient of one (1) for chemicals that elicit only noncancer effects (e.g., liver toxicity). Conservative default exposure assumptions that reflect either residential exposure or industrial worker exposure to soil are used, along with the target risk factors and toxicity values, to estimate the RSLs. When a chemical has the potential to cause cancer and noncancer toxicity effects, the lower of the two endpoint-specific values is used as the RSL. Additionally, if a risk-based concentration exceeds either the soil saturation concentration (Csat) or the ceiling limit of 100,000 mg/kg, the appropriate value will replace the risk-based concentration as the SL. Note that, while this approach will be used for the purpose of selecting the screening levels for determining whether a constituent is selected as a COPC for further evaluation in the baseline risk assessment, the risks estimated for the COPCs in the risk assessment will be based on the most current toxicity value available, as reflected in the RSL documentation.

For chromium and mercury, the RSL for the form most likely to be found at MGP sites was selected. Specifically, for chromium, the form present in soil depends on specific soil properties (e.g., eh, pH, mineralogy). In most soils, chromium is present predominantly as trivalent chromium (Cr^{3+}) (ATSDR 2012). Chromium may have been present at trace concentrations in MGP feedstock (i.e., coal or crude oil) at any MGP site (GRI 1996). However, combustion of these feedstocks results in emissions that contain only a small percentage (0.2%) of hexavalent chromium (Cr^{6+}) (ATSDR 2012). Thus, the RSL for Cr^{3+} was used as the SL. Mercury is a naturally occurring element that is usually found as mercuric sulfide (cinnabar), an insoluble, stable mercury salt, rather than as elemental mercury (ATSDR 1999). Because the most common form of mercury is mercuric sulfide, the RSL for mercury salts such as mercury sulfide is selected as the most appropriate RSL for mercury at MGP sites.

Integrys Sites in Illinois

The soil SLs for Illinois sites are presented in Tables 3 and 4. The first tier of the soil screening hierarchy for Illinois sites relies on the RSLs as described for Wisconsin sites. When an RSL was not available, a tiered approach to corrective action objectives (TACO) soil criterion developed by the Illinois Environmental Protection Agency (IEPA) was used. The most current promulgated TACO values were used (IEPA 2013c). TACO criteria are developed for residential, commercial workers, and construction workers. However, construction-worker TACO values were not used in the hierarchy, because they were derived using exposure assumptions very different from those used to derive commercial TACO and industrial RSL screening values. The lowest of the available residential TACO criteria (ingestion or inhalation

routes) were used as the residential SL when an RSL was not available. The lowest of the available commercial-worker TACO criteria (ingestion or inhalation routes) were used as the SLs for workers when an industrial RSL was not available.

If neither an RSL nor a TACO value was available, then a non-TACO value was used as the Illinois SL, if available. Non-TACO values are developed by IEPA using provisional toxicity values, but are not promulgated soil standards within Illinois. The most current non-TACO values available were used (October 30, 2012; IEPA 2012). The selection of residential and commercial/industrial non-TACO values followed the same scheme as that developed for TACO values (i.e., the lowest of available residential or commercial/industrial values was used).

For arsenic in Illinois soils, TACO recommends using a background concentration rather than a risk-based value. Thus, in Tables 3 and 4, the SLs presented for arsenic are the background concentration for counties within the metropolitan statistical areas (13.0 mg/kg) and the background concentration for counties outside the metropolitan statistical areas (11.3 mg/kg) (IEPA 2013c, Appendix A, Table G). The site-specific risk assessments will note that the Illinois background soil concentrations presented above are higher than the risk-based values calculated for the RSLs (i.e., 0.61 mg/kg for residential RSL and 2.4 mg/kg for industrial RSL). Additionally, on a site-specific basis, it may be appropriate to use background concentrations for selected polycyclic aromatic hydrocarbons (PAHs) in soils as another point of comparison in addition to the RSLs, because some of the PAH RSLs are below levels for the City of Chicago (IEPA 2013c, Appendix A, Table H). Such instances would be documented in the site-specific risk assessment and would be compared to both the soil RSL and the soil background criteria.

Groundwater Screening Levels

For screening groundwater at Integrys MGP sites within either Wisconsin or Illinois, the process will entail doing separate comparisons for each of three SLs: the tapwater RSL, the federal drinking-water standard (i.e., MCL [U.S. EPA 2009]), and the State-specific groundwater standard.

For Wisconsin sites, the state-specific regulation is the Wisconsin NR 140 Enforcement Standard (WDNR 2012a). For Illinois sites, the first tier of state-specific regulations is the Illinois Groundwater Quality Standards (IEPA 2013d). For Illinois sites, the TACO groundwater remediation objectives will be used as a second tier for any analyte not listed in the groundwater quality standards, and the non-TACO groundwater remediation objective will be used as a third tier (IEPA 2012). The groundwater SLs and their sources are summarized by state in Tables 5 and 6.

Indoor Air Screening Levels

Indoor air SLs were selected separately for residential and industrial land use. Indoor air RSLs were used as the indoor air SLs for both Wisconsin and Illinois sites. These indoor air SLs will be used for indoor air investigations where the potential for vapor intrusion into a building exists based on subsurface soil or groundwater contamination associated with former MGP-related operations. The indoor air RSLs are summarized in Tables 7 and 8 for both residential and

industrial properties. The EPA indoor air RSLs are used for both Wisconsin and Illinois MGP sites, because at this time, Illinois has no promulgated indoor air risk-based screening values, and Wisconsin adopted the indoor air RSLs as their source of risk-based indoor air screening values in their VI guidance (WDNR 2012b).

Vapor Intrusion Screening Levels for Soil Gas and Groundwater

For evaluating the vapor intrusion pathway, results from soil gas samples collected below a building (i.e., sub-slab) and/or collected external to a building will be compared to the appropriate screening levels described below. For external samples collected outside a building in areas not covered by asphalt or concrete, efforts will be made to collect these samples from at least 5 ft below ground surface, so that the potential for introducing ambient air into the soil gas sample is minimized. If site-specific circumstances necessitate the collection of soil gas samples at depths of less than 5 ft (e.g., shallow depth of the water table), the data collected in this manner will be evaluated separately in the risk assessment rather than being dismissed. The reason for the shallow depth of the samples, and uncertainty associated with these shallower-than-ideal samples, will be clearly noted. The EPA-approved standard operating procedure (SOP) for soil gas sampling for the Multi-Site Program (SOP SAS-11-06) states that probes will be installed no shallower than 2 feet below ground surface.

The VI SLs for soil gas and groundwater were calculated using the most current version of the VISL calculator developed by EPA (VISL-Calculator.xlsm, version 3.3, May 2014). The methods used by EPA to calculate the VI SLs are documented in the VISL User's Guide (U.S. EPA 2014b). The toxicity values used in the VISL calculator are updated by EPA each time they update the RSLs.

The VISL calculator estimates the VI SL for each analyte by using the indoor air RSLs (residential or industrial) as a target air concentration, combined with a medium-specific (i.e., soil gas or groundwater)-to-building attenuation factor, plus an additional chemical-specific factor (Henry's Law constant) for groundwater.

The VI SLs for soil gas and groundwater (based on a groundwater temperature of 25°C) are presented in Tables 7 and 8. Only VI SLs for compounds that are both sufficiently volatile and have an inhalation toxicity value are summarized in these tables. Those compounds considered sufficiently volatile were determined based on their categorization in the RSL table as "volatile." The two criteria used to determine whether an analyte is volatile are the chemical's molecular weight and its Henry's Law constant, as discussed in more detail in the RSL documentation and VISL guide. Both parameters are presented in the RSL documentation. The presence or absence of an inhalation toxicity value was also determined using the toxicity information presented in the RSL documentation. The VISL calculator automatically determines which analytes are both sufficiently volatile and have an inhalation toxicity value.

The attenuation factors listed below are currently used by the VISL calculator for derivation of the soil gas and groundwater VI SLs.

- Soil Gas 0.1
- Groundwater 0.001

These attenuation factors are currently under review by EPA headquarters, but are presently recommended as "conservative 'generic' attenuation factors that reflect generally reasonable worst-case conditions" for purposes of developing the initial VI SLs (U.S. EPA 2014b).

If, on a site-specific basis, other less conservative attenuation factors appear appropriate, they will be used to update the initial VI screening analysis. One such possible site-specific instance might be when evaluating VI for a large building for which specific criteria are met (e.g., increased size of building, thickness of floor, and greater air exchange rate). In such a situation, an alternative set of attenuation factors might be incorporated if site-specific building characteristics can justify the use of less conservative (i.e., lower) attenuation factors. For example, WDNR has incorporated this flexibility in their current approach within the VI guidance (WDNR 2012b) for large commercial buildings where the building factors listed above (e.g., building size) are documented and can be used to substantiate the use of lower attenuation factors. In the case of the Wisconsin VI guidance, an attenuation factor 10-fold lower than the default value is applied to address the increased attenuation that occurs within larger buildings. Such alternative VI evaluations will be communicated to EPA on a site-specific basis, and the justification for their application will be documented in the remedial investigation work plan or other relevant document.

Soil gas SLs are calculated by the VISL calculator using the following equation:

$$\text{Soil gas VI SL } (\mu g/m^3) = \frac{\text{Indoor air RSL } (\mu g/m^3)}{\text{Soil gas attenuation factor (dimensionless)}}$$

Groundwater VI SLs are calculated by the VISL calculator using the following equation:

$$\text{Groundwater VI SL } (\mu g/L) = \text{Indoor air RSL } (\mu g/m^3) \times \frac{1}{\text{Groundwater attenuation factor}} \times \frac{1}{\text{Henry's Law constant (dimensionless)}} \times 0.001\ m^3/L$$

The groundwater VI SLs are generated by the VISL calculator assuming a default average groundwater temperature of 25 °C. This default value results in conservatively high groundwater VI SLs, because groundwater temperature is typically lower than 25 °C, and the volatility of a chemical from groundwater decreases as the groundwater temperature decreases. The VISL calculator allows the user to adjust the average temperature of the groundwater to a site-specific value. For this reason, the groundwater data will be reviewed on a site-specific basis, and if appropriate, an average groundwater temperature value will be derived and used in the VISL calculator to develop a site-specific set of groundwater VI SLs.

The VI SLs presented herein are based on a default target cancer risk of 1×10^{-6} and noncancer hazard quotient of 1 (Tables 7 and 8). For those analytes that can cause both carcinogenic and noncancer effects (e.g., benzene), the lower of the cancer- and noncancer-based SLs are presented in the screening tables.

Other conventions used by the VISL calculator are as follows:

- If the calculated VI soil gas SL exceeds its maximum chemical vapor-phase concentration, then the calculator yields NVT (not sufficiently volatile and/or toxic to pose inhalation risk)
- If the calculated groundwater VI SL exceeds the solubility for the pure chemical, then the calculator yields NVT (not sufficiently volatile and/or toxic to pose inhalation risk).

Cumulative Risk Check for Noncancer Effects

The SLs presented in this addendum for soil, indoor air, soil gas, and vapor migration from groundwater will be used as the first step in the human health screening process within the baseline risk assessment.[1] For each analyte, the maximum observed concentration will be compared to the SL to determine whether it should be carried forward into the baseline risk assessment as a COPC for further evaluation.

For noncarcinogens, an additional check will be performed to determine whether exposure to the multiple chemicals identified at the site will result in exceedance of the cumulative noncancer risk target (i.e., a hazard index of one). The process to perform this check is depicted in Figure 1.

To perform the check, the maximum concentration of each noncarcinogenic chemical detected at the site will be divided by its medium-specific SL, and then these individual ratios (i.e., hazard quotients) will be summed across all non-carcinogens detected at the site. If the sum of the hazard quotients results in a hazard index exceeding the value of 1, then those chemicals responsible for the exceedance will be carried forward for further evaluation within the baseline risk assessment, as described in Figure 1.

[1] Formal risk calculations for direct contact with groundwater will not be performed in the baseline risk assessment, because groundwater is not used as drinking water at any of these sites, so the special conditions discussed in this section do not apply for this exposure pathway.

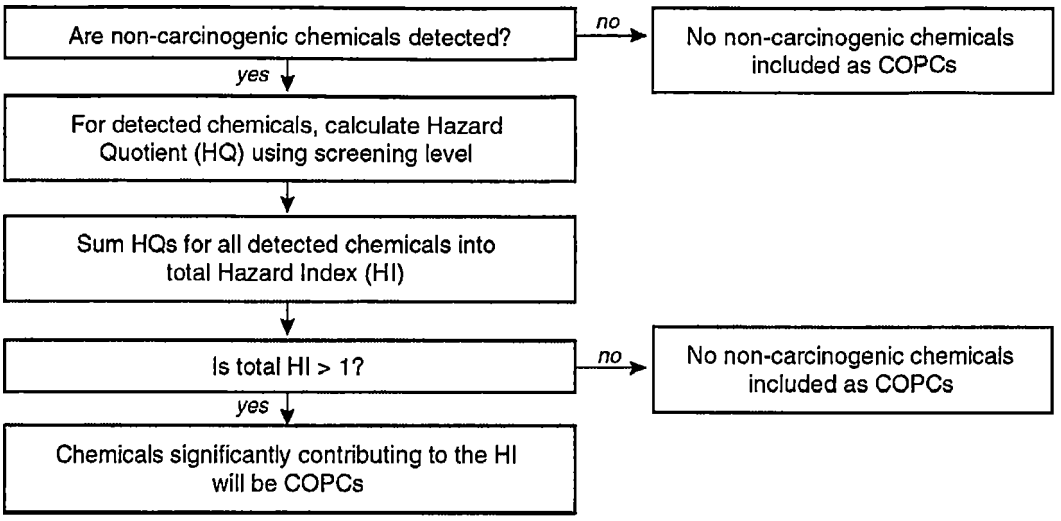

Figure 1. Screening check for cumulative non-carcinogenic effects

Construction-Worker Evaluation

Currently, EPA does not have construction-worker-specific screening levels to address potential risks to this receptor group. Typically, construction-worker exposures at a Site are shorter in duration than residential and industrial workers' exposures, so SLs that are considered protective of residential or industrial workers are in most cases thought to conservatively reflect concentration limits that would be protective of construction workers as well. However, in certain site-specific circumstances, construction workers may be exposed to certain media (e.g., NAPL, chemical vapors or soil gas, and groundwater) that are not reflected by the exposure pathways evaluated for developing residential or industrial worker SLs. For example, a construction worker may dig into the soils and perform work in an excavation that could potentially expose them to soil, groundwater, and chemical vapors in different ways from those assumed for the residential and industrial worker RSLs. In these instances, the residential or industrial-worker SLs may not reflect concentration limits that would be protective of construction workers. For Integrys MGP sites, the potential risks to future construction workers will be evaluated on a site-specific basis considering the environmental conditions at each MGP Site and the likely future land use.

The type of risk evaluation that may be performed for a potential future construction-worker population (i.e., qualitative, semi-quantitative, or fully-quantitative) at an Integrys MGP site will depend on site-specific circumstances. The selection of the construction worker risk evaluation option will be based on review of all the site-specific data available, and will be documented in the site-specific work plan and in the baseline risk assessment.

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Table 1. Residential soil screening levels for Integrys sites in Wisconsin

Analyte	CAS #	Selected Concentration Soil Residential (mg/kg)	Source	Comments for Selected Value	U.S. EPA (2014a) RSL Soil Residential (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)
Semivolatile Organic Compounds						
Polynuclear Aromatic Hydrocarbons						
Acenaphthene	83-32-9	3,500 n	RSL		3,500 n	--
Acenaphthylene	208-96-8	3,500 n	RSL	Used surrogate of acenaphthene (83-32-9)	3,500 n	--
Anthracene	120-12-7	17,000 n	RSL		17,000 n	--
Benzo[a]anthracene	56-55-3	0.15 c	RSL		0.15 c	--
Benzo[a]pyrene	50-32-8	0.015 c	RSL		0.015 c	--
Benzo[b]fluoranthene	205-99-2	0.15 c	RSL		0.15 c	--
Benzo[g,h,i]perylene	191-24-2	1,700 n	RSL	Used surrogate of pyrene (129-00-0)	1,700 n	--
Benzo[k]fluoranthene	207-08-9	1.5 c	RSL		1.5 c	--
Chrysene	218-01-9	15 c	RSL		15 c	--
Dibenz[a,h]anthracene	53-70-3	0.015 c	RSL		0.015 c	--
Fluoranthene	206-44-0	2,300 n	RSL		2,300 n	--
Fluorene	86-73-7	2,300 n	RSL		2,300 n	--
Indeno[1,2,3-cd]pyrene	193-39-5	0.15 c	RSL		0.15 c	--
2-Methylnaphthalene	91-57-6	230 n	RSL		230 n	--
Naphthalene	91-20-3	3.8 c*	RSL		3.8 c*	--
Phenanthrene	85-01-8	17,000 n	RSL	Used surrogate of anthracene (120-12-7)	17,000 n	--
Pyrene	129-00-0	1,700 n	RSL		1,700 n	--
Phenols						
2,4-Dimethylphenol	105-67-9	1,200 n	RSL		1,200 n	--
2-Methylphenol (o-Cresol)	95-48-7	3,100 n	RSL		3,100 n	--
3&4-Methylphenol (m&p)	108-39-4	3,100 n	RSL	Used value for m-cresol (108-39-4)	3,100 n	--
Phenol	108-95-2	18,000 n	RSL		18,000 n	--
Volatile Organic Compounds						
Benzene	71-43-2	1.2 c*	RSL		1.2 c*	1,820
Ethylbenzene	100-41-4	5.8 c	RSL		5.8 c	480
Toluene	108-88-3	818 n	sat		4,900 ns	818
1,2,4-Trimethylbenzene	95-63-6	58 n	RSL		58 n	219
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		780 ns	182
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	550 ns	388
o-Xylene	95-47-6	434 n	sat		650 ns	434
Xylene (total)	1330-20-7	258 n	sat		580 ns	258
Metals and Inorganics						
Aluminum	7429-90-5	77,000 n	RSL		77,000 n	--
Antimony	7440-36-0	31 n	RSL	Antimony (metallic)	31 n	--
Arsenic	7440-38-2	8.0	background[1]	Arsenic, inorganic	0.67 c*	--
Barium	7440-39-3	15,000 n	RSL		15,000 n	--
Cadmium	7440-43-9	70 n	RSL	Dietary value	70 n	--
Chromium	7440-47-3	100,000 n	max	Used value for Cr(III)	120,000 nm	--
Copper	7440-50-8	3,100 n	RSL		3,100 n	--
Iron	7439-89-6	55,000 n	RSL		55,000 n	--
Lead	7439-92-1	400 n	RSL	Lead and compounds	400 n	--
Manganese	7439-96-5	1,800 n	RSL	Used non-dietary value	1,800 n	--
Mercury	7487-94-7	23 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	23 n	--
Nickel	7440-02-0	1,500 n	RSL	Nickel soluble salts	1,500 n	--
Selenium	7782-49-2	390 n	RSL		390 n	--
Silver	7440-22-4	390 n	RSL		390 n	--
Vanadium	7440-62-2	390 n	RSL	Vanadium and compounds	390 n	--
Zinc	7440-66-6	23,000 n	RSL	Zinc (metallic)	23,000 n	--
Cyanide	57-12-5	78 n	RSL	Used sodium cyanide (143-33-9)	78 n	--

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level.

For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at Integrys MGP sites. The source of the selected screening value is presented to the right of the numerical value.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated May 2014 (U.S. EPA 2014a) (http://www.epa.gov/region9/superfund/prg.

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
m – concentration may exceed ceiling limit
max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
s – concentration may exceed C_{sat} (soil saturation concentration)
sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.

[1] Concentration is the background threshold value (BTV) for Wisconsin, determined by Wisconsin Department of Natural Resources (WDNR 2013b).

Table 2. Industrial soil screening levels for Integrys sites in Wisconsin

Analyte	CAS #	Selected Concentration Soil Industrial (mg/kg)	Source	Comments for Selected Value	U.S. EPA (2014a) RSL Soil Industrial (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)
Semivolatile Organic Compounds						
Polynuclear Aromatic Hydrocarbons						
Acenaphthene	83-32-9	45,000 n	RSL		45,000 n	--
Acenaphthylene	208-96-8	45,000 n	RSL	Used surrogate of acenaphthene (83-32-9)	45,000 n	--
Anthracene	120-12-7	100,000 n	max		230,000 nm	--
Benzo[a]anthracene	56-55-3	2.9 c	RSL		2.9 c	--
Benzo[a]pyrene	50-32-8	0.29 c	RSL		0.29 c	--
Benzo[b]fluoranthene	205-99-2	2.9 c	RSL		2.9 c	--
Benzo[g,h,i]perylene	191-24-2	23,000 n	RSL	Used surrogate of pyrene (129-00-0)	23,000 n	--
Benzo[k]fluoranthene	207-08-9	29 c	RSL		29 c	--
Chrysene	218-01-9	290 c	RSL		290 c	--
Dibenz[a,h]anthracene	53-70-3	0.29 c	RSL		0.29 c	--
Fluoranthene	206-44-0	30,000 n	RSL		30,000 n	--
Fluorene	86-73-7	30,000 n	RSL		30,000 n	--
Indeno[1,2,3-cd]pyrene	193-39-5	2.9 c	RSL		2.9 c	--
2-Methylnaphthalene	91-57-6	3,000 n	RSL		3,000 n	--
Naphthalene	91-20-3	17 c*	RSL		17 c*	--
Phenanthrene	85-01-8	100,000 n	max	Used surrogate of anthracene (120-12-7)	230,000 nm	--
Pyrene	129-00-0	23,000 n	RSL		23,000 n	--
Phenols						
2,4-Dimethylphenol	105-67-9	16,000 n	RSL		16,000 n	--
2-Methylphenol (o-Cresol)	95-48-7	41,000 n	RSL		41,000 n	--
3&4-Methylphenol (m&p)	108-39-4	41,000 n	RSL	Used value for m-cresol (108-39-4)	41,000 n	--
Phenol	108-95-2	100,000 n	max		250,000 nm	--
Volatile Organic Compounds						
Benzene	71-43-2	5.1 c*	RSL		5.1 c*	1,820
Ethylbenzene	100-41-4	25 c	RSL		25 c	480
Toluene	108-88-3	818 n	sat		47,000 ns	818
1,2,4-Trimethylbenzene	95-63-6	219 n	sat		240 ns	219
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		12,000 ns	182
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	2,400 ns	388
o-Xylene	95-47-6	434 n	sat		2,800 ns	434
Xylene (total)	1330-20-7	258 n	sat		2,500 ns	258
Metals and Inorganics						
Aluminum	7429-90-5	100,000 n	max		1,100,000 nm	--
Antimony	7440-36-0	470 n	RSL	Antimony (metallic)	470 n	--
Arsenic	7440-38-2	8.0	background[1]	Arsenic, inorganic	3.0 c	--
Barium	7440-39-3	100,000 n	max		220,000 nm	--
Cadmium	7440-43-9	980 n	RSL	Dietary value	980 n	--
Chromium	7440-47-3	100,000 n	max	Used value for Cr(III)	1,800,000 nm	--
Copper	7440-50-8	47,000 n	RSL		47,000 n	--
Iron	7439-89-6	100,000 n	max		820,000 nm	--
Lead	7439-92-1	800 n	RSL	Lead and compounds	800 n	--
Manganese	7439-96-5	26,000 n	RSL	Used non-dietary value	26,000 n	--
Mercury	7487-94-7	350 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	350 n	--
Nickel	7440-02-0	22,000 n	RSL	Nickel soluble salts	22,000 n	--
Selenium	7782-49-2	5,800 n	RSL		5,800 n	--
Silver	7440-22-4	5,800 n	RSL		5,800 n	--
Vanadium	7440-62-2	5,800 n	RSL	Vanadium and compounds	5,800 n	--
Zinc	7440-66-6	100,000 n	max	Zinc (metallic)	350,000 nm	--
Cyanide	57-12-5	1,200 n	RSL	Used sodium cyanide (143-33-9)	1,200 n	--

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level.

For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at Integrys MGP sites. The source of the selected screening value is presented to the right of the numerical value.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated May 2014 (U.S. EPA 2014a) (http://www.epa.gov/region9/superfund/prg.

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
m – concentration may exceed ceiling limit
max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
s – concentration may exceed C_{sat} (soil saturation concentration)
sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.

[1] Concentration is the background threshold value (BTV) for Wisconsin, determined by Wisconsin Department of Natural Resources (WDNR 2013b).

Table 3. Residential soil screening levels for Integrys sites in Illinois

Analyte	CAS #	Selected Concentration Soil Residential (mg/kg)	Source	Comments for Selected Value	U.S. EPA (2014a) RSL Soil Residential (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Residential Ingestion (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Residential Inhalation (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Residential Ingestion (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Residential Inhalation (mg/kg)
Semivolatile Organic Compounds										
Polynuclear Aromatic Hydrocarbons										
Acenaphthene	83-32-9	3,500 n	RSL		3,500 n	--	4,700 n	--	--	--
Acenaphthylene	208-96-8	3,500 n	RSL	Used surrogate of acenaphthene (83-32-9)	3,500 n	--	--	--	2,300 n	--
Anthracene	120-12-7	17,000 n	RSL		17,000 n	--	23,000 n	--	--	--
Benzo[a]anthracene	56-55-3	0.15 c	RSL		0.15 c	--	0.9 c,w	--	--	--
Benzo[a]pyrene	50-32-8	0.015 c	RSL		0.015 c	--	0.09 c,w	--	--	--
Benzo[b]fluoranthene	205-99-2	0.15 c	RSL		0.15 c	--	0.9 c,w	--	--	--
Benzo[g,h,i]perylene	191-24-2	1,700 n	RSL	Used surrogate of pyrene (129-00-0)	1,700 n	--	--	--	2,300 n	--
Benzo[k]fluoranthene	207-08-9	1.5 c	RSL		1.5 c	--	9 c	--	--	--
Chrysene	218-01-9	15 c	RSL		15 c	--	88 c	--	--	--
Dibenz[a,h]anthracene	53-70-3	0.015 c	RSL		0.015 c	--	0.09 c,w	--	--	--
Fluoranthene	206-44-0	2,300 n	RSL		2,300 n	--	3,100 n	--	--	--
Fluorene	86-73-7	2,300 n	RSL		2,300 n	--	3,100 n	--	--	--
Indeno[1,2,3-cd]pyrene	193-39-5	0.15 c	RSL		0.15 c	--	0.9 c,w	--	--	--
2-Methylnaphthalene	91-57-6	230 n	RSL		230 n	--	--	--	310 n	--
Naphthalene	91-20-3	3.8 c*	RSL		3.8 c*	--	1,600 n	170 n	--	--
Phenanthrene	85-01-8	17,000 n	RSL	Used surrogate of anthracene (120-12-7)	17,000 n	--	--	--	2,300 n	--
Pyrene	129-00-0	1,700 n	RSL		1,700 n	--	2,300 n	--	--	--
Phenols										
2,4-Dimethylphenol	105-67-9	1,200 n	RSL		1,200 n	--	1,600 n	--	--	--
2-Methylphenol (o-Cresol)	95-48-7	3,100 n	RSL		3,100 n	--	3,900 n	--	--	--
3&4-Methylphenol (m&p)	108-39-4	3,100 n	RSL	Used value for m-cresol (108-39-4)	3,100 n	--	--	--	3,900 n	8,100 d
Phenol	108-95-2	18,000 n	RSL		18,000 n	--	23,000 n	--	--	--
Volatile Organic Compounds										
Benzene	71-43-2	1.2 c*	RSL		1.2 c*	1,820	12 c	0.8 c	--	--
Ethylbenzene	100-41-4	5.8 c	RSL		5.8 c	480	7,800 n	400 d	--	--
Toluene	108-88-3	818 n	sat		4,900 ns	818	16,000 n	650 d	--	--
1,2,4-Trimethylbenzene	95-63-6	58 n	RSL		58 n	219	--	--	--	87 n
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		780 ns	182	--	--	780 n	--
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	550 ns	388	16,000 n	460 d	--	--
o-Xylene	95-47-6	434 n	sat		650 ns	434	16,000 n	410 d	--	--
Xylene (total)	1330-20-7	258 n	sat		580 ns	258	16,000 n	320 d	--	--
Metals and Inorganics										
Aluminum	7429-90-5	77,000 n	RSL		77,000 n	--	--	--	78,000 n	1,000,000 n
Antimony	7440-36-0	31 n	RSL	Antimony (metallic)	31 n	--	31 n	--	--	--
Arsenic	7440-38-2	13.0 / 11.3	background[1]	Arsenic, inorganic	0.67 c*	--	13.0 / 11.3 t	750 c	--	--
Barium	7440-39-3	15,000 n	RSL		15,000 n	--	5,500 n	690,000 n	--	--
Cadmium	7440-43-9	70 n	RSL	Dietary value	70 n	--	78 n	1,800 c	--	--
Chromium	7440-47-3	100,000 n	max	Used value for Cr(III)	120,000 nm	--	230 n	270 c	--	--
Copper	7440-50-8	3,100 n	RSL		3,100 n	--	2,900 n	--	--	--
Iron	7439-89-6	55,000 n	RSL		55,000 n	--	--	--	--	--
Lead	7439-92-1	400 n	RSL		400 n	--	400 n	--	--	--
Manganese	7439-96-5	1,800 n	RSL	Used non-dietary value	1,800 n	--	1,600 n,v	69,000 n	--	--
Mercury	7487-94-7	23 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	23 n	--	23 n	10 n	--	--
Nickel	7440-02-0	1,500 n	RSL	Nickel soluble salts	1,500 n	--	1,600 n	13,000 c	--	--
Selenium	7782-49-2	390 n	RSL		390 n	--	390 n	--	--	--
Silver	7440-22-4	390 n	RSL		390 n	--	390 n	--	--	--
Vanadium	7440-62-2	390 n	RSL	Vanadium and compounds	390 n	--	550 n	--	--	--
Zinc	7440-66-6	23,000 n	RSL	Zinc (metallic)	23,000 n	--	23,000 n	--	--	--
Cyanide	57-12-5	78 n	RSL	Used sodium cyanide (143-33-9)	78 n	--	1,600 n	--	--	--

(footnotes on following page)

Table 3. Residential soil screening levels for Integrys sites in Illinois

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at Integrys MGP sites. The source of the selected screening value is presented to the right of the numerical value.

Hierarchy for soil screening criteria:
RSL, then TACO, then non-TACO value.
For all TACO and non-TACO soil remediation objectives, the lowest of the two pathway-specific (i.e., ingestion or inhalation) values is used.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated May 2014 (U.S. EPA 2014a) (http://www.epa.gov/region9/superfund/prg/)

TACO and non-TACO
Illinois Tiered Approach to Corrective Action Objectives (TACO), soil remediation objectives, Title 35 Part 742 (IEPA 2013c) (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO objectives (IEPA 2012) (http://www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html)

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- d – soil saturation concentration (C_{sat}) – the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached; above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.
- t – values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) from 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils];
- v – value based on reference dose adjusted for dietary intake
- w – for sites located in any populated area as defined in Section 742.200, Appendix A, Table H may be used [Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils]; see text for details

[1] Concentrations are the Illinois background concentrations for arsenic from TACO. Values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) are taken from IEPA 2013c, 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils].

Table 4. Industrial soil screening levels for Integrys sites in Illinois

Analyte	CAS #	Selected Concentration Soil Industrial (mg/kg)	Source	Comments for Selected Value	U.S. EPA (2014a) RSL Soil Industrial (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Industrial Ingestion (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Industrial Inhalation (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Industrial Ingestion (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Industrial Inhalation (mg/kg)
Semivolatile Organic Compounds										
Polynuclear Aromatic Hydrocarbons										
Acenaphthene	83-32-9	45,000 n	RSL		45,000 n	--	120,000 n	--	--	--
Acenaphthylene	208-96-8	45,000 n	RSL	Used surrogate of acenaphthene (83-32-9)	45,000 n	--	--	--	61,000 n	--
Anthracene	120-12-7	100,000 n	max		230,000 nm	--	610,000 n	--	--	--
Benzo[a]anthracene	56-55-3	2.9 c	RSL		2.9 c	--	8 c	--	--	--
Benzo[a]pyrene	50-32-8	0.29 c	RSL		0.29 c	--	0.8 c,w	--	--	--
Benzo[b]fluoranthene	205-99-2	2.9 c	RSL		2.9 c	--	8 c	--	--	--
Benzo[g,h,i]perylene	191-24-2	23,000 n	RSL	Used surrogate of pyrene (129-00-0)	23,000 n	--	--	--	61,000 n	--
Benzo[k]fluoranthene	207-08-9	29 c	RSL		29 c	--	78 c	--	--	--
Chrysene	218-01-9	290 c	RSL		290 c	--	780 c	--	--	--
Dibenz[a,h]anthracene	53-70-3	0.29 c	RSL		0.29 c	--	0.8 c	--	--	--
Fluoranthene	206-44-0	30,000 n	RSL		30,000 n	--	82,000 n	--	--	--
Fluorene	86-73-7	30,000 n	RSL		30,000 n	--	82,000 n	--	--	--
Indeno[1,2,3-cd]pyrene	193-39-5	2.9 c	RSL		2.9 c	--	8 c	--	--	--
2-Methylnaphthalene	91-57-6	3,000 n	RSL		3,000 n	--	--	--	8,200 n	--
Naphthalene	91-20-3	17 c*	RSL		17 c*	--	41,000 n	270 n	--	--
Phenanthrene	85-01-8	100,000 n	max	Used surrogate of anthracene (120-12-7)	230,000 nm	--	--	--	61,000 n	--
Pyrene	129-00-0	23,000 n	RSL		23,000 n	--	61,000 n	--	--	--
Phenols										
2,4-Dimethylphenol	105-67-9	16,000 n	RSL		16,000 n	--	41,000 n	--	--	--
2-Methylphenol (o-Cresol)	95-48-7	41,000 n	RSL		41,000 n	--	100,000 n	--	--	--
3&4-Methylphenol (m&p)	108-39-4	41,000 n	RSL	Used value for m-cresol (108-39-4)	41,000 n	--	--	--	100,000 n	8,100 d
Phenol	108-95-2	100,000 n	max		250,000 nm	--	610,000 n	--	--	--
Volatile Organic Compounds										
Benzene	71-43-2	5.1 c*	RSL		5.1 c*	1,820	100 c	1.6 c	--	--
Ethylbenzene	100-41-4	25 c	RSL		25 c	480	200,000 n	400 d	--	--
Toluene	108-88-3	818 n	sat		47,000 ns	818	410,000 n	650 d	--	--
1,2,4-Trimethylbenzene	95-63-6	219 n	sat		240 ns	219	--	--	--	140 n
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		12,000 ns	182	--	--	20,000 n	--
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	2,400 ns	388	410,000 n	460 d	--	--
o-Xylene	95-47-6	434 n	sat		2,800 ns	434	410,000 n	410 d	--	--
Xylene (total)	1330-20-7	258 n	sat		2,500 ns	258	410,000 n	320 d	--	--
Metals and Inorganics										
Aluminum	7429-90-5	100,000 n	max		1,100,000 nm	--	--	--	1,000,000 n	1,000,000 n
Antimony	7440-36-0	470 n	RSL	Antimony (metallic)	470 n	--	820 n	--	--	--
Arsenic	7440-38-2	13.0 / 11.3	background[1]	Arsenic, inorganic	3.0 c	--	13.0 / 11.3 t	1,200 c	--	--
Barium	7440-39-3	100,000 n	max		220,000 nm	--	140,000 n	910,000 n	--	--
Cadmium	7440-43-9	980 n	RSL	Dietary value	980 n	--	2,000 n	2,800 c	--	--
Chromium	7440-47-3	100,000 n	max	Cr(III) for soil	1,800,000 nm	--	6,100 n	420 c	--	--
Copper	7440-50-8	47,000 n	RSL		47,000 n	--	82,000 n	--	--	--
Iron	7439-89-6	100,000 n	max		820,000 nm	--	--	--	--	--
Lead	7439-92-1	800 n	RSL		800 n	--	800 n	--	--	--
Manganese	7439-96-5	26,000 n	RSL	Used non-dietary value	26,000 n	--	41,000 n,v	91,000 n	--	--
Mercury	7487-94-7	350 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	350 n	--	610 n	16 n	--	--
Nickel	7440-02-0	22,000 n	RSL	Nickel soluble salts	22,000 n	--	41,000 n	21,000 c	--	--
Selenium	7782-49-2	5,800 n	RSL		5,800 n	--	10,000 n	--	--	--
Silver	7440-22-4	5,800 n	RSL		5,800 n	--	10,000 n	--	--	--
Vanadium	7440-62-2	5,800 n	RSL	Vanadium and compounds	5,800 n	--	14,000 n	--	--	--
Zinc	7440-66-6	100,000 n	max	Zinc (metallic)	350,000 nm	--	610,000 n	--	--	--
Cyanide	57-12-5	1,200 n	RSL	Used sodium cyanide (143-33-9)	1,200 n	--	41,000 n	--	--	--

(footnotes on following page)

Table 4. Industrial soil screening levels for Integrys sites in Illinois

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. *Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at Integrys MGP sites. The source of the selected* screening value is presented to the right of the numerical value.

Hierarchy for soil screening criteria:
RSL, then TACO, then non-TACO value.
For all TACO and non-TACO soil remediation objectives, the lowest of the two pathway-specific (i.e., ingestion or inhalation) values was used.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated May 2014 (U.S. EPA 2014a) (http://www.epa.gov/region9/superfund/prg/)

TACO and non-TACO
Illinois Tiered Approach to Corrective Action Objectives (TACO), soil remediation objectives, Title 35 Part 742 (IEPA 2013c) (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO objectives (IEPA 2012) (http://www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html)

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- d – soil saturation concentration (C_{sat}) – the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached; above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.
- t – values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) from 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils];
- v – value based on reference dose adjusted for dietary intake
- w – for sites located in any populated area as defined in Section 742.200, Appendix A, Table H may be used [Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils]; see text for details

[1] Per the Illinois state guidance in TACO, the background concentration is used for comparison to site concentrations. Values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) are taken from IEPA 2013c, 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils].

Table 5. Groundwater screening levels for Integrys sites in Wisconsin

Analyte	CAS #	Screening Criteria: U.S. EPA (2014a) RSL Tapwater (µg/L)	Screening Criteria: U.S. EPA (2009) Maximum Contaminant Level (µg/L)	Screening Criteria: WDNR (2012a) NR140 Groundwater Enforcement Standard (µg/L)	Comments
Semivolatile Organic Compounds					
Polynuclear Aromatic Hydrocarbons					
Acenaphthene	83-32-9	530 n	--	--	
Acenaphthylene	208-96-8	530 n	--	--	Used surrogate of acenaphthene (83-32-9)
Anthracene	120-12-7	1,800 n	--	3,000	
Benzo[a]anthracene	56-55-3	0.034 c	--	--	
Benzo[a]pyrene	50-32-8	0.0034 c	0.2	0.2	
Benzo[b]fluoranthene	205-99-2	0.034 c	--	0.2	
Benzo[g,h,i]perylene	191-24-2	120 n	--	--	Used surrogate of pyrene (129-00-0)
Benzo[k]fluoranthene	207-08-9	0.34 c	--	--	
Chrysene	218-01-9	3.4 c	--	0.2	
Dibenz[a,h]anthracene	53-70-3	0.0034 c	--	--	
Fluoranthene	206-44-0	800 n	--	400	
Fluorene	86-73-7	290 n	--	400	
Indeno[1,2,3-cd]pyrene	193-39-5	0.034 c	--	--	
2-Methylnaphthalene	91-57-6	36 n	--	--	
Naphthalene	91-20-3	0.17 c*	--	100	
Phenanthrene	85-01-8	1,800 n	--	--	Used surrogate of anthracene (120-12-7)
Pyrene	129-00-0	120 n	--	250	
Phenols					
2,4-Dimethylphenol	105-67-9	360 n	--	--	
3&4-Methylphenol (m&p)	108-39-4	930 n	--	--	Used value for m-cresol (108-39-4)
2-Methylphenol (o-Cresol)	95-48-7	930 n	--	--	
Phenol	108-95-2	5,800 n	--	2,000	
Volatile Organic Compounds					
Benzene	71-43-2	0.45 c*	5	5	
Ethylbenzene	100-41-4	1.5 c	700	700	
Toluene	108-88-3	1,100 n	1,000	800	
1,2,4-Trimethylbenzene	95-63-6	15 n	--	--	
1,3,5-Trimethylbenzene	108-67-8	120 n	--	--	
m&p-Xylene	108-38-3	190 n	--	--	Used value for m-xylene (108-38-3)
o-Xylene	95-47-6	190 n	--	--	
Xylene (total)	1330-20-7	190 n	10,000	2,000	
Metals and Inorganics					
Aluminum	7429-90-5	20,000 n	--	200	
Antimony	7440-36-0	7.8 n	6	6	
Arsenic	7440-38-2	0.052 c	10	10	
Barium	7440-39-3	3,800 n	2,000	2,000	
Cadmium	7440-43-9	9.2 n	5	5	
Chromium	7440-47-3	22,000 n	100	100	For MCL: Cr (total); For RSL: Cr(III)
Copper	7440-50-8	800 n	1,300	1,300	
Iron	7439-89-6	14,000 n	--	--	
Lead	7439-92-1	15 n	15	15	
Manganese	7439-96-5	430 n	--	300	
Mercury	7487-94-7	5.7 n	2	2	For RSL: mercuric chloride (& other Hg salts)
Nickel	7440-02-0	390 n	--	100	For RSL: nickel soluble salts
Selenium	7782-49-2	100 n	50	50	
Silver	7440-22-4	94 n	--	50	
Vanadium	7440-62-2	86 n	--	30	
Zinc	7440-66-6	6,000 n	--	--	
Cyanide	57-12-5	20 n[a]	200 [a]	200 [a]	For RSL: sodium cyanide; For WI: cyanide, free

Notes: Site concentrations will be screened separately against all three sets of criteria. Any analyte exceeding any criteria will be considered a chemical of potential concern.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated May 2014 (U.S. EPA 2014a) (http://www.epa.gov/region9/superfund/prg/)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

WI NR140: WI NR 140 groundwater quality enforcement standards published in Register 673, dated January 2012 (WDNR 2012a) (http://docs.legis.wisconsin.gov/code/admin_code/nr/140.pdf)

c -- screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000

c* -- where the non-cancer screening level is < 100× cancer screening level

n -- screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1

[a] Groundwater cyanide concentration results based on the available cyanide analysis method (OIA 1677) will be compared to cyanide groundwater criterion.

Table 6. Groundwater screening levels for Integrys sites in Illinois

Analyte	CAS #	Screening Criteria: U.S. EPA (2014a) RSL Tapwater (µg/L)	Screening Criteria: U.S. EPA (2009) Maximum Contaminant Level (µg/L)	Screening Criteria: Selected Illinois Groundwater Value[a] (µg/L)	IEPA (2013d) Illinois Groundwater Quality Standard Class I (µg/L)	IEPA (2013c) TACO Remediation Objective, Class I Groundwater (µg/L)	IEPA (2012) Non-TACO Remediation Objective, Class I Groundwater (µg/L)	Comments
Semivolatile Organic Compounds								
Polynuclear Aromatic Hydrocarbons								
Acenaphthene	83-32-9	530 n	--	420 QS	420	420	--	
Acenaphthylene	208-96-8	530 n	--	210 non-TACO	--	--	210	Used surrogate of acenaphthene (83-32-9) for RSL
Anthracene	120-12-7	1,800 n	--	2,100 QS	2,100	2,100	--	
Benzo[a]anthracene	56-55-3	0.034 c	--	0.13 QS	0.13	0.13	--	
Benzo[a]pyrene	50-32-8	0.0034 c	0.2	0.2 QS	0.2	0.2	--	
Benzo[b]fluoranthene	205-99-2	0.034 c	--	0.18 QS	0.18	0.18	--	
Benzo[g,h,i]perylene	191-24-2	120 n	--	210 non-TACO	--	--	210	Used surrogate of pyrene (129-00-0) for RSL
Benzo[k]fluoranthene	207-08-9	0.34 c	--	0.17 QS	0.17	0.17	--	
Chrysene	218-01-9	3.4 c	--	12 QS	12	1.5	--	
Dibenz[a,h]anthracene	53-70-3	0.0034 c	--	0.3 QS	0.3	0.3	--	
Fluoranthene	206-44-0	800 n	--	280 QS	280	280	--	
Fluorene	86-73-7	290 n	--	280 QS	280	280	--	
Indeno[1,2,3-cd]pyrene	193-39-5	0.034 c	--	0.43 QS	0.43	0.43	--	
2-Methylnaphthalene	91-57-6	36 n	--	28 QS	28	--	28	
Naphthalene	91-20-3	0.17 c*	--	140 QS	140	140	--	
Phenanthrene	85-01-8	1,800 n	--	210 non-TACO	--	--	210	Used surrogate of anthracene (120-12-7) for RSL
Pyrene	129-00-0	120 n	--	210 QS	210	210	--	
Phenols								
2,4-Dimethylphenol	105-67-9	360 n	--	140 TACO	--	140	--	
2-Methylphenol (o-Cresol)	95-48-7	930 n	--	350 QS	350	350	--	
3&4-Methylphenol (m&p)	108-39-4	930 n	--	350 non-TACO	--	--	35	Used value for m-cresol (108-39-4)
Phenol	108-95-2	5,800 n	--	100 QS	100	100	--	
Volatile Organic Compounds								
Benzene	71-43-2	0.45 c*	5	5 QS	5	5	--	
Ethylbenzene	100-41-4	1.5 c	700	700 QS	700	700	--	
Toluene	108-88-3	1,100 n	1,000	1,000 QS	1,000	1,000	--	
1,2,4-Trimethylbenzene	95-63-6	15 n	--	--	--	--	--	
1,3,5-Trimethylbenzene	108-67-8	120 n	--	70 non-TACO	--	--	70	
m&p-Xylene	108-38-3	190 n	--	--	--	--	--	Used value for m-xylene (108-38-3) for RSL
o-Xylene	95-47-6	190 n	--	--	--	--	--	
Xylene (total)	1330-20-7	190 n	10,000	10,000 QS	10,000	10,000	--	
Metals and Inorganics								
Aluminum	7429-90-5	20,000 n	--	3,500 non-TACO	--	--	3,500	
Antimony	7440-36-0	7.8 n	6	6 QS	6	6	--	
Arsenic	7440-38-2	0.052 c	10	10 QS	10	50	--	
Barium	7440-39-3	3,800 n	2,000	2,000 QS	2,000	2,000	--	
Cadmium	7440-43-9	9.2 n	5	5 QS	5	5	--	
Chromium	7440-47-3	22,000 n	100	100 QS	100	100	--	For MCL: Cr (total); For RSL: Cr(III)
Copper	7440-50-8	800 n	1,300	650 QS	650	650	--	
Iron	7439-89-6	14,000 n	--	5,000 QS	5,000	5,000	--	
Lead	7439-92-1	15	15	7.5 QS	7.5	7.5	--	
Manganese	7439-96-5	430 n	--	150 QS	150	150	--	
Mercury	7487-94-7	5.7 n	2	2 QS	2	2	--	For RSL: mercuric chloride (& other Hg salts)
Nickel	7440-02-0	390 n	--	100 QS	100	100	--	For RSL: nickel soluble salts
Selenium	7782-49-2	100 n	50	50 QS	50	50	--	
Silver	7440-22-4	94 n	--	50 QS	50	50	--	
Vanadium	7440-62-2	86 n	--	49 QS	49	49	--	
Zinc	7440-66-6	6,000 n	--	5,000 QS	5,000	5,000	--	
Cyanide	57-12-5	20 n[b]	200 [b]	200 QS[b]	200	200	--	For RSL: sodium cyanide (143-33-9)

(footnotes on following page)

Table 6. Groundwater screening levels for Integrys sites in Illinois

Notes: Site concentrations will be screened separately against all three sets of criteria. Any analyte exceeding any criteria will be considered a chemical of potential concern.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated May 2014 (U.S. EPA 2014a) (http://www.epa.gov/region9/superfund/prg/)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

Illinois standards or objectives

Illinois Groundwater Quality Standards for Class I: Potable Resource, Title 35 Part 620 (IEPA 2013d) (www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois Tiered Approach to Corrective Action Objectives (TACO), groundwater remediation objectives, Title 35 Part 742 (IEPA 2013c) (www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO objectives (IEPA 2012) (www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
non-TACO – value is the Illinois non-TACO objective
QS – value is the Illinois groundwater quality standard
TACO – value is the Illinois TACO groundwater remediation objective

[a] Hierarchy for selected Illinois groundwater screening criteria: Groundwater quality standard, then TACO remediation objective, then non-TACO remediation objective.

[b] Groundwater cyanide concentration results based on the available cyanide analysis method (OIA 1677) will be compared to cyanide groundwater criterion.

Table 7. Residential vapor intrusion screening levels for sites in Illinois and Wisconsin

Analyte	CAS #	Selected Risk-Based Concentrations, Residential: Indoor Air RSL (µg/m³)	Soil Gas (µg/m³)	Groundwater, Vapor Intrusion (µg/L)	Comments for Selected Value	U.S. EPA (2009) Maximum Contaminant Level (µg/L)
Semivolatile Organic Compounds						
Polynuclear Aromatic Hydrocarbons						
Naphthalene	91-20-3	0.083 c*	0.83 c	4.6 c		--
Volatile Organic Compounds						
Benzene	71-43-2	0.36 c	3.6 c	1.6 c	MCL is higher than groundwater VI value	5
Ethylbenzene	100-41-4	1.1 c	11 c	3.4 c	MCL is higher than groundwater VI value	700
Toluene	108-88-3	5,200 n	52,000 n	19,000 n		1,000
1,2,4-Trimethylbenzene	95-63-6	7.3 n	73 n	29 n		--
1,3,5-Trimethylbenzene	108-67-8	7.3 n	73 n	20 n	Used RfC for 1,2,4-trimethylbenzene	--
m&p-Xylene	108-38-3	100 n	1,000 n	340 n	Used value for m-xylene (108-38-3)	--
o-Xylene	95-47-6	100 n	1,000 n	470 n		--
Xylene (total)	1330-20-7	100 n	1,000 n	470 n	MCL is higher than groundwater VI value	10,000

Notes:

The vapor intrusion soil gas and groundwater screening values are based on the indoor air RSL, and derived using EPA's Vapor Instrusion Screening Level Calculator, Version 3.3 (updated using May 2014 RSLs, epa.gov/oswer/vaporintrusion/guidance.html).

The groundwater vapor intrusion values are based on a default groundwater temperature of 25°C. Only analytes that are sufficiently volatile and have available inhalation toxicity values are presented.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated May 2014 (U.S. EPA 2014a) (http://www.epa.gov/region9/superfund/prg/)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
RfC – reference concentration
VI – vapor intrusion

Table 8. Industrial vapor intrusion screening levels for sites in Illinois and Wisconsin

Analyte	CAS #	Selected Risk-Based Concentrations, Industrial: Indoor Air RSL (µg/m^3)	Soil Gas (µg/m^3)	Groundwater, Vapor Intrusion (µg/L)	Comments for Selected Value	U.S. EPA (2009) Maximum Contaminant Level (µg/L)
Semivolatile Organic Compounds						
Polynuclear Aromatic Hydrocarbons						
Naphthalene	91-20-3	0.36 c*	3.6 c	20 c		--
Volatile Organic Compounds						
Benzene	71-43-2	1.6 c*	16 c	6.9 c		5
Ethylbenzene	100-41-4	4.9 c	49 c	15 c	MCL is higher than groundwater VI value	700
Toluene	108-88-3	22,000 n	220,000 n	81,000 n		1,000
1,2,4-Trimethylbenzene	95-63-6	31 n	310 n	120 n		--
1,3,5-Trimethylbenzene	108-67-8	31 n	310 n	86 n	Used RfC for 1,2,4-trimethylbenzene	--
m&p-Xylene	108-38-3	440 n	4,400 n	1,500 n	Used value for m-xylene (108-38-3)	--
o-Xylene	95-47-6	440 n	4,400 n	2,100 n		--
Xylene (total)	1330-20-7	440 n	4,400 n	2,100 n	MCL is higher than groundwater VI value	10,000

Notes:

The vapor intrusion soil gas and groundwater screening values are based on the indoor air RSL, and derived using EPA's Vapor Instrusion Screening Level Calculator, Version 3.3 (updated using May 2014 RSLs, epa.gov/oswer/vaporintrusion/guidance.html).

The groundwater vapor intrusion values are based on a default groundwater temperature of 25°C. Only analytes that are sufficiently volatile and have available inhalation toxicity values are presented.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated May 2014 (U.S. EPA 2014a) (http://www.epa.gov/region9/superfund/prg/)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
RfC – reference concentration
VI – vapor intrusion

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Technical Memorandum (Revision 4)
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Risk Assessment Framework Addendum (Revision 4)

This document represents an addendum to the human health risk screening levels (SLs) originally presented in the Multi-Site Risk Assessment Framework (RAF) for former manufactured gas plant sites (MGPs), prepared for Wisconsin Public Service Corporation, The Peoples Gas Light and Coke Company, and North Shore Gas Company (Exponent 2007). Elements of this addendum supersede and replace those presented in the original RAF (Exponent 2007) and previous versions of this RAF Addendum (Exponent 2011, 2014a,b). The human health SLs have been updated to incorporate the regional screening levels (RSLs; U.S. EPA 2015a) that the U.S. Environmental Protection Agency (EPA) developed after the RAF was approved. The EPA RSLs have become the standard screening levels for the initial screening step in human health risk assessments, and are now typically updated every six months. In addition, vapor intrusion (VI) SLs, which were not presented in the RAF, are incorporated in this addendum. The VI SLs are based on the RSLs and were calculated using the most recent Vapor Intrusion Screening Level (VISL) Calculator developed by EPA (U.S. EPA 2015b), which incorporates new information from the recently released *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (U.S. EPA 2015c). This RAF Addendum (Revision 4) updates the previous revision with the use of the most recent iteration of the RSLs. A separate list of SLs is provided for Wisconsin and Illinois sites to reflect the differences between the States' regulations.

SLs for MGP-related constituents of potential concern (COPCs), presented in Table 1 of the RAF, are summarized by medium within this document. On a site-specific basis, if other non-MGP-related analytes require consideration, human health SLs will be selected for those analytes using the processes specified in this addendum.

The human health SLs will be updated as the sources presented in this document are updated (e.g., when new versions of RSLs or the VISL calculator become available), or if, in the future, new sources of SLs become available. As appropriate, an update to this document will be provided shortly after an update to one or more sources of SLs.

Hierarchy Used to Develop Human Health Screening Levels

Human health SLs are provided for soil, groundwater, and VI-related media (i.e., indoor air, soil gas, and groundwater) in this addendum. A hierarchical approach was used to select human health SLs by analyte within each medium. When an SL is available from the highest tier source, values from lower tier sources are not used.

Hierarchy for All Media other than Directly Contacted Groundwater—The RSL values are used as the first-tier source of SLs for soil and indoor air, and as the basis for the VI–related SLs (i.e., soil gas and groundwater) that are calculated using the VISL calculator. For Illinois sites, State risk-based screening criteria are used as a second-tier (and sometimes third-tier) source of SLs to fill gaps where RSLs are not available. For Wisconsin sites, the State has transitioned to

using RSLs as the basis of screening criteria for soil and VI–related media (indoor air and soil gas), as discussed further below; therefore, no second-tier screening criteria are used for soil or VI–related media.

Hierarchy for Directly Contacted Groundwater —For the groundwater direct-contact SLs, the site groundwater data will be compared separately to the tapwater RSLs, the federal maximum contaminant levels ([MCLs], U.S. EPA 2009), and State-promulgated drinking-water standards. As discussed in Section 5.2 of the RAF, these comparisons will be done to assess the potential risk if groundwater were to be used as a drinking-water source. The groundwater screening evaluation will be used in the baseline risk assessment only to determine whether concentrations of groundwater contaminants occur at levels that present a potential risk. The results of the groundwater screening will be documented in the risk assessment, but the risk assessment for this medium will not proceed beyond this screening step, because groundwater is not used as a drinking-water source at any of these sites. It is anticipated that the potential risk associated with groundwater will be assessed in the feasibility study, and if potential risks are present, they may be mitigated using risk management tools and/or remediation.

Medium-Specific Human Health Screening Levels

The methods used to develop and select the SLs by medium are presented in this section.

Soil Screening Levels

Soil SLs were selected separately for residential and industrial/commercial land use. For simplicity, the industrial/commercial SLs are labeled as "industrial" SLs within this document and in the associated tables. The soil SLs for MGP sites located in Wisconsin are presented in Tables 1 and 2, and the soil SLs for MGP sites located in Illinois are presented in Tables 3 and 4. Due to recent changes described herein, many of the sources of soil SLs are the same for both states. However, separate tables will be maintained to accommodate the small number of differences that exist between the two states in analyte-specific SLs.

MGP Sites in Wisconsin

The soil SLs to be used at MGP sites in Wisconsin are presented in Table 1 (residential) and Table 2 (industrial). The Wisconsin Department of Natural Resources (WDNR) publishes a guidance document that recommends determining state-specific soil residual contaminant levels using the EPA RSL web calculator (WDNR 2014). This Wisconsin guidance recommends using EPA-provided default inputs for residential and industrial scenarios to estimate soil SLs, with the exception of the climatic zone. The climatic zone specified by the WDNR guidance is the Chicago zone. Because the default climatic zone used by EPA in developing the RSLs will produce concentrations that are slightly lower in some cases than the Wisconsin recommended zone (Chicago), for conservativeness, this Addendum will adopt the default RSLs for MGP sites in Wisconsin. On a site-specific basis, region-specific SLs may be used. In these cases, the regional adjustments will be documented in the site-specific risk assessment, Site-Specific Work Plan (SSWP), or other relevant document.

For arsenic in Wisconsin soils, Wisconsin has developed a background threshold value (BTV) of 8 mg/kg based on extensive sampling by the U.S. Geological Survey (WDNR 2013a). Based

on the direction provided in NR 720 and comments provided through EPA, this BTV will be used as the soil SL for MGP sites in Wisconsin (WDNR 2013b; U.S. EPA 2013c). The site-specific risk assessments will note that the BTV is higher than the risk-based values calculated for the RSLs (e.g., 0.68 mg/kg for residential and 3 mg/kg for industrial). Additionally in each site-specific risk assessment, when there are one or more exceedances of the BTV, the risks associated with arsenic will be documented in two ways. Specifically, a calculation of total arsenic risk will be performed using the site concentration as well as calculation of incremental arsenic risk above the BTV).

The RSLs for each analyte are developed based on a target cancer risk of one in one million (1×10^{-6}) for carcinogenic chemicals, or a target hazard quotient of one (1) for chemicals that elicit only noncancer effects (e.g., liver toxicity). Conservative default exposure assumptions that reflect either residential exposure or industrial worker exposure to soil are used, along with the target risk factors and toxicity values, to estimate the RSLs. When a chemical has the potential to cause cancer and noncancer toxicity effects, the lower of the two endpoint-specific values is used as the RSL. Additionally, if a risk-based concentration exceeds either the soil saturation concentration (Csat) or the ceiling limit of 100,000 mg/kg, the appropriate value will replace the risk-based concentration as the SL. Note that, while this approach will be used for the purpose of selecting the screening levels for determining whether a constituent is selected as a COPC for further evaluation in the baseline risk assessment, the risks estimated for the COPCs in the risk assessment will be based on the most current toxicity value available, as reflected in the RSL documentation.

For chromium and mercury, the RSL for the form most likely to be found at MGP sites was selected. Specifically, for chromium, the form present in soil depends on specific soil properties (e.g., eh, pH, mineralogy). In most soils, chromium is present predominantly as trivalent chromium (Cr^{3+}) (ATSDR 2012). Chromium may have been present at trace concentrations in MGP feedstock (i.e., coal or crude oil) at any MGP site (GRI 1996). However, combustion of these feedstocks results in emissions that contain only a small percentage (0.2%) of hexavalent chromium (Cr^{6+}) (ATSDR 2012). Thus, the RSL for Cr^{3+} was used as the SL. Mercury is a naturally occurring element that is usually found as mercuric sulfide (cinnabar), an insoluble, stable mercury salt, rather than as elemental mercury (ATSDR 1999). Because the most common form of mercury is mercuric sulfide, the RSL for mercury salts such as mercury sulfide is selected as the most appropriate RSL for mercury at MGP sites.

MGP Sites in Illinois

The soil SLs for Illinois sites are presented in Tables 3 and 4. The first tier of the soil screening hierarchy for Illinois sites relies on the RSLs as described for Wisconsin sites. When an RSL was not available, a tiered approach to corrective action objectives (TACO) soil criterion developed by the Illinois Environmental Protection Agency (IEPA) was used. The most current promulgated TACO values were used (IEPA 2013c). TACO criteria are developed for residential, commercial workers, and construction workers. However, construction-worker TACO values were not used in the hierarchy, because they were derived using exposure assumptions very different from those used to derive commercial TACO and industrial RSL screening values. The lowest of the available residential TACO criteria (ingestion or inhalation routes) were used as the residential SL when an RSL was not available. The lowest of the

available commercial-worker TACO criteria (ingestion or inhalation routes) were used as the SLs for workers when an industrial RSL was not available.

If neither an RSL nor a TACO value was available, then a non-TACO value was used as the Illinois SL, if available. Non-TACO values are developed by IEPA using provisional toxicity values, but are not promulgated soil standards within Illinois. The most current non-TACO values available were used (October 30, 2012; IEPA 2012). The selection of residential and commercial/industrial non-TACO values followed the same scheme as that developed for TACO values (i.e., the lowest of available residential or commercial/industrial values was used).

For arsenic in Illinois soils, TACO recommends using a background concentration rather than a risk-based value. Thus, in Tables 3 and 4, the SLs presented for arsenic are the background concentration for counties within the metropolitan statistical areas (13.0 mg/kg) and the background concentration for counties outside the metropolitan statistical areas (11.3 mg/kg) (IEPA 2013c, Appendix A, Table G). The site-specific risk assessments will note that the Illinois background soil concentrations presented above are higher than the risk-based values calculated for the RSLs (i.e., 0.68 mg/kg for residential RSL and 3 mg/kg for industrial RSL). Additionally in each site-specific risk assessment, when there are one or more exceedances of the applicable Illinois background arsenic concentration, the risks associated with arsenic will be documented in two ways. Specifically, a calculation of total arsenic risk will be performed using the site concentration as well as calculation of incremental arsenic risk above the background concentration).

On a site-specific basis, it may be appropriate to use background criteria for polycyclic aromatic hydrocarbons (PAHs) in soils as another point of comparison in addition to the RSLs. For example some of the PAH RSLs are below background PAH criteria for the City of Chicago (Exponent 2015). Such instances would be documented in the site-specific risk assessment and the full dataset would be compared to both the soil RSLs and the soil background criteria. While background PAH comparisons may be made in the risk assessment, these comparisons will not be used to eliminate soil samples from further evaluation in the risk assessment.

Groundwater Screening Levels

For screening groundwater at MGP sites within either Wisconsin or Illinois, the process will entail doing separate comparisons for each of three SLs: the tapwater RSL, the federal drinking-water standard (i.e., MCL [U.S. EPA 2009]), and the State-specific groundwater standard.

For Wisconsin sites, the state-specific regulation is the Wisconsin NR 140 Enforcement Standard (WDNR 2015). For Illinois sites, the first tier of state-specific regulations is the Illinois Groundwater Quality Standards (IEPA 2013d). For Illinois sites, the TACO groundwater remediation objectives will be used as a second tier for any analyte not listed in the groundwater quality standards, and the non-TACO groundwater remediation objective will be used as a third tier (IEPA 2012). The groundwater SLs and their sources are summarized by state in Tables 5 and 6.

Indoor Air Screening Levels

Indoor air SLs were selected separately for residential and industrial land use. Indoor air RSLs were used as the indoor air SLs for both Wisconsin and Illinois sites. These indoor air SLs will be used for indoor air investigations where the potential for vapor intrusion into a building exists based on subsurface soil or groundwater contamination associated with former MGP-related operations. The indoor air RSLs are summarized in Tables 7 and 8 for both residential and industrial properties. The EPA indoor air RSLs are used for both Wisconsin and Illinois MGP sites, because at this time, Illinois has no promulgated indoor air risk-based screening values, and Wisconsin adopted the indoor air RSLs as their source of risk-based indoor air screening values in their VI guidance (WDNR 2012a).

Vapor Intrusion Screening Levels for Soil Gas and Groundwater

For evaluating the vapor intrusion pathway, results from groundwater or soil gas samples collected below a building (i.e., sub-slab) and/or collected external to a building will be compared to the appropriate screening levels described below. For external samples collected outside a building in areas not covered by asphalt or concrete, efforts will be made to collect these samples from at least 5 ft below ground surface, so that the potential for introducing ambient air into the soil gas sample is minimized. If site-specific circumstances necessitate the collection of soil gas samples at depths of less than 5 ft (e.g., shallow depth of the water table), the data collected in this manner will be evaluated separately in the risk assessment rather than being dismissed. The reason for the shallow depth of the samples, and uncertainty associated with these shallower-than-ideal samples, will be clearly noted. The EPA-approved standard operating procedure (SOP) for soil gas sampling for the Multi-Site Program (SOP SAS-11-06) states that probes will be installed no shallower than 2 feet below ground surface.

The VI SLs for soil gas and groundwater were calculated using the most current version of the VISL calculator developed by EPA (VISL-Calculator.xlsm, version 3.4, June 2015) which incorporates new assumptions from the recently release VI guidance (U.S. EPA 2015c).[1] The toxicity values used in the VISL calculator are updated by EPA each time they update the RSLs. The VI screening values from EPA are being used preferentially over the values provided in the Illinois TACO values (IEPA 2013c) because the EPA values are noticeably lower and the attenuation factors used by EPA are based on an observational database rather than modeling.

The VISL calculator estimates the VI SL for each analyte by using the indoor air RSLs (residential or industrial) as a target air concentration, combined with a medium-specific (i.e., soil gas or groundwater)-to-building attenuation factor, plus an additional chemical-specific factor (Henry's Law constant) for groundwater.

The VI SLs for soil gas and groundwater (based on a groundwater temperature of 25°C) are presented in Tables 7 and 8. Only VI SLs for compounds that are both sufficiently volatile and have an inhalation toxicity value are summarized in these tables. Those compounds considered

[1] The general methods used by EPA to calculate the VI SLs are documented in the VISL User's Guide (U.S. EPA 2014). The VISL User's Guide has not yet been updated by EPA (as of December 2015) to incorporate new assumptions from the recent VI guidance (U.S. EPA 2015c) even though the VISL calculator has already been updated to incorporates these new assumptions.

sufficiently volatile were determined based on their categorization in the RSL table as "volatile." The two criteria used to determine whether an analyte is volatile are the chemical's vapor pressure and its Henry's Law constant, as discussed in more detail in the new VI guidance (EPA 2015c) and VISL calculator (Version 3.4, June 2015). Both parameters are also presented in the RSL documentation. The presence or absence of an inhalation toxicity value was also determined using the toxicity information presented in the RSL documentation. The VISL calculator automatically determines which analytes are both sufficiently volatile and have an inhalation toxicity value.

The attenuation factors listed below are currently used by the VISL calculator for derivation of the soil gas and groundwater VI SLs.

- Soil Gas 0.03
- Groundwater 0.001

These attenuation factors are presently recommended as conservative 'generic' attenuation factors based on an analysis of a database of observations from residential buildings for purposes of developing the initial VI SLs (U.S. EPA 2015c).

If, on a site-specific basis, other less conservative attenuation factors appear appropriate, they will be used to update the initial VI screening analysis. One such possible site-specific instance might be when evaluating VI for a large building for which specific criteria are met (e.g., increased size of building, thickness of floor, and greater air exchange rate). In such a situation, an alternative set of attenuation factors might be incorporated if site-specific building characteristics can justify the use of less conservative (i.e., lower) attenuation factors. For example, WDNR has incorporated this flexibility in their current approach within the VI guidance (WDNR 2012a) for large commercial buildings where the building factors listed above (e.g., building size) are documented and can be used to substantiate the use of lower attenuation factors. In the case of the Wisconsin VI guidance, an attenuation factor 10-fold lower than the default value is applied to address the increased attenuation that occurs within larger buildings. Such alternative VI evaluations will be communicated to EPA on a site-specific basis, and the justification for their application will be documented in the remedial investigation work plan or other relevant document.

Soil gas SLs are calculated by the VISL calculator using the following equation:

$$\text{Soil gas VI SL } (\mu g/m^3) = \frac{\text{Indoor air RSL } (\mu g/m^3)}{\text{Soil gas attenuation factor (dimensionless)}}$$

Groundwater VI SLs are calculated by the VISL calculator using the following equation:

$$\text{Groundwater VI SL } (\mu g/L) = \text{Indoor air RSL } (\mu g/m^3) \times \frac{1}{\text{Groundwater attenuation factor}} \times \frac{1}{\text{Henry's Law constant (dimensionless)}} \times 0.001\ m^3/L$$

The groundwater VI SLs are generated by the VISL calculator assuming a default average groundwater temperature of 25 °C. This default value results in conservatively high groundwater VI SLs, because groundwater temperature is typically lower than 25 °C, and the

volatility of a chemical from groundwater decreases as the groundwater temperature decreases. The VISL calculator allows the user to adjust the average temperature of the groundwater to a site-specific value. For this reason, the groundwater data will be reviewed on a site-specific basis, and if appropriate, an average groundwater temperature value will be derived and used in the VISL calculator to develop a site-specific set of groundwater VI SLs.

The VI SLs presented herein are based on a default target cancer risk of 1×10^{-6} and noncancer hazard quotient of 1 (Tables 7 and 8). For those analytes that can cause both carcinogenic and noncancer effects (e.g., benzene), the lower of the cancer- and noncancer-based SLs are presented in the screening tables.

Other conventions used by the VISL calculator are as follows:

- If the calculated target indoor air concentration is higher than the pure phase vapor concentration at 25°C, then the calculator yields NVT (for not sufficiently volatile and/or toxic to pose inhalation risk in selected exposure scenario for the indicated medium) instead of a concentration value
- If the calculated target groundwater concentration is higher than the pure component water solubility, then the calculator yields NVT (for not sufficiently volatile and/or toxic to pose inhalation risk in selected exposure scenario for the indicated medium) instead of a concentration value.

Cumulative Risk Check for Noncancer Effects

The SLs presented in this addendum for soil, indoor air, soil gas, and vapor migration from groundwater will be used as the first step in the human health screening process within the baseline risk assessment.[2] For each analyte, the maximum observed concentration will be compared to the SL to determine whether it should be carried forward into the baseline risk assessment as a COPC for further evaluation.

For noncarcinogens, an additional check will be performed to determine whether exposure to the multiple chemicals identified at the site will result in exceedance of the cumulative noncancer risk target (i.e., a hazard index of one). The process to perform this check is depicted in Figure 1.

To perform the check, the maximum concentration of each noncarcinogenic chemical detected at the site will be divided by its medium-specific SL, and then these individual ratios (i.e., hazard quotients) will be summed across all non-carcinogens detected at the site. If the sum of the hazard quotients results in a hazard index exceeding the value of 1, then those chemicals responsible for the exceedance will be carried forward for further evaluation within the baseline risk assessment, as described in Figure 1.

[2] Formal risk calculations for direct contact with groundwater will not be performed in the baseline risk assessment, because groundwater is not used as drinking water at any of these sites, so the special conditions discussed in this section do not apply for this exposure pathway.

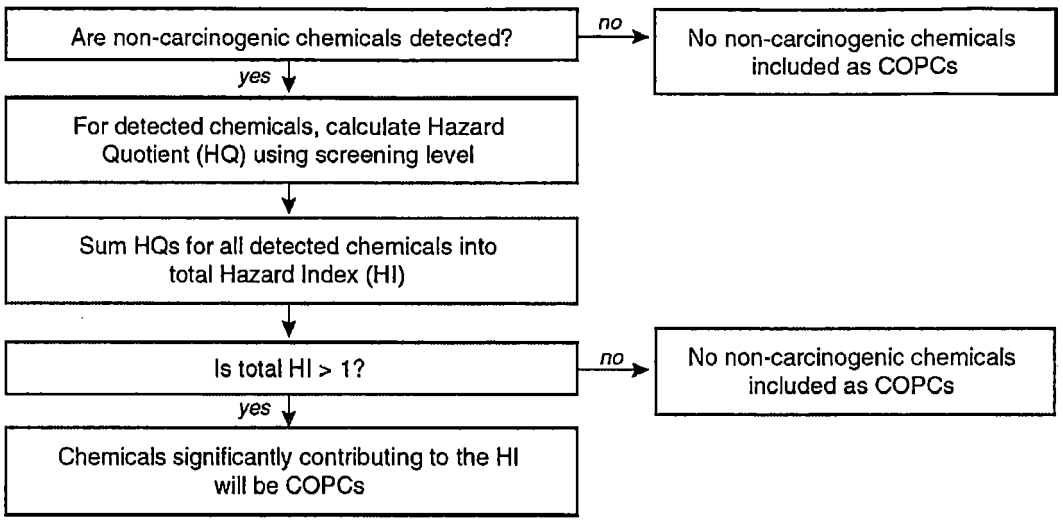

Figure 1. Screening check for cumulative non-carcinogenic effects

Construction-Worker Evaluation

Currently, EPA does not have construction-worker-specific screening levels to address potential risks to this receptor group. Typically, construction-worker exposures at a Site are shorter in duration than residential and industrial workers' exposures, so SLs that are considered protective of residential or industrial workers are in most cases thought to conservatively reflect concentration limits that would be protective of construction workers as well. However, in certain site-specific circumstances, construction workers may be exposed to certain media (e.g., NAPL, chemical vapors or soil gas, and groundwater) that are not reflected by the exposure pathways evaluated for developing residential or industrial worker SLs. For example, a construction worker may dig into the soils and perform work in an excavation that could potentially expose them to soil, groundwater, and chemical vapors in different ways from those assumed for the residential and industrial worker RSLs. In these instances, the residential or industrial-worker SLs may not reflect concentration limits that would be protective of construction workers. For MGP sites, the potential risks to future construction workers will be evaluated on a site-specific basis considering the environmental conditions at each MGP Site and the likely future land use.

The type of risk evaluation that may be performed for a potential future construction-worker population (i.e., qualitative, semi-quantitative, or fully-quantitative) at an MGP site will depend on site-specific circumstances. The selection of the construction worker risk evaluation option will be based on review of all the site-specific data available, and will be documented in the site-specific work plan and in the baseline risk assessment.

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Table 1. Residential soil screening levels for MGP sites in Wisconsin RAF Addendum (Revision 4)

Analyte	CAS #	Selected Concentration Soil Residential (mg/kg)	Source	Comments	U.S. EPA (2015a) RSL Soil Residential (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	83-32-9	3,600 n	RSL		3,600 n	--
Acenaphthylene	208-96-8	3,600 n	RSL	Used surrogate of acenaphthene (83-32-9)	3,600 n	--
Anthracene	120-12-7	18,000 n	RSL		18,000 n	--
Benzo[a]anthracene	56-55-3	0.16 c	RSL		0.16 c	--
Benzo[a]pyrene	50-32-8	0.016 c	RSL		0.016 c	--
Benzo[b]fluoranthene	205-99-2	0.16 c	RSL		0.16 c	--
Benzo[g,h,i]perylene	191-24-2	1,800 n	RSL	Used surrogate of pyrene (129-00-0)	1,800 n	--
Benzo[k]fluoranthene	207-08-9	1.6 c	RSL		1.6 c	--
Chrysene	218-01-9	16 c	RSL		16 c	--
Dibenz[a,h]anthracene	53-70-3	0.016 c	RSL		0.016 c	--
Fluoranthene	206-44-0	2,400 n	RSL		2,400 n	--
Fluorene	86-73-7	2,400 n	RSL		2,400 n	--
Indeno[1,2,3-cd]pyrene	193-39-5	0.16 c	RSL		0.16 c	--
2-Methylnaphthalene	91-57-6	240 n	RSL		240 n	--
Naphthalene	91-20-3	3.8 c*	RSL		3.8 c*	--
Phenanthrene	85-01-8	18,000 n	RSL	Used surrogate of anthracene (120-12-7)	18,000 n	--
Pyrene	129-00-0	1,800 n	RSL		1,800 n	--
Phenols						
2,4-Dimethylphenol	105-67-9	1,300 n	RSL		1,300 n	--
2-Methylphenol (o-Cresol)	95-48-7	3,200 n	RSL		3,200 n	--
3&4-Methylphenol (m&p)	108-39-4	3,200 n	RSL	Used value for m-cresol (108-39-4)	3,200 n	--
Phenol	108-95-2	19,000 n	RSL		19,000 n	--
Volatile Organic Compounds						
Benzene	71-43-2	1.2 c*	RSL		1.2 c*	1,820
Ethylbenzene	100-41-4	5.8 c	RSL		5.8 c	480
Toluene	108-88-3	818 n	sat		4,900 ns	818
1,2,4-Trimethylbenzene	95-63-6	58 n	RSL		58 n	219
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		780 ns	182
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	550 ns	388
o-Xylene	95-47-6	434 n	sat		650 ns	434
Xylene (Total)	1330-20-7	260 n	sat		580 ns	260
Metals and Inorganics						
Aluminum	7429-90-5	77,000 n	RSL		77,000 n	--
Antimony	7440-36-0	31 n	RSL	Antimony (metallic)	31 n	--
Arsenic	7440-38-2	8.0	background[1]	Arsenic, inorganic	0.68 c*	--
Barium	7440-39-3	15,000 n	RSL		15,000 n	--
Cadmium	7440-43-9	71 n	RSL	Dietary value	71 n	--
Chromium	7440-47-3	100,000 n	max	Cr(III) for soil	120,000 nm	--
Copper	7440-50-8	3,100 n	RSL		3,100 n	--
Iron	7439-89-6	55,000 n	RSL		55,000 n	--
Lead	7439-92-1	400	RSL		400	--
Manganese	7439-96-5	1,800 n	RSL	Used non-dietary value	1,800 n	--
Mercury	7487-94-7	23 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	23 n	--
Nickel	7440-02-0	1,500 n	RSL	Nickel soluble salts	1,500 n	--
Selenium	7782-49-2	390 n	RSL		390 n	--
Silver	7440-22-4	390 n	RSL		390 n	--
Vanadium	7440-62-2	390 n	RSL		390 n	--
Zinc	7440-66-6	23,000 n	RSL		23,000 n	--
Cyanide	57-12-5	78 n	RSL	Used sodium cyanide (143-33-9)	78 n	--

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at MGP sites. The source of the selected screening value is presented to the right of the numerical value.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2015 (U.S. EPA 2015a) (www.epa.gov/risk/risk-based-screening-table-generic-ta

c -- screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* -- where the non-cancer screening level is < 100× cancer screening level
m -- concentration may exceed ceiling limit
max -- risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
n -- screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
s -- concentration may exceed C_{sat} (soil saturation concentration)
sat -- risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.

[1] Concentration is the background threshold value (BTV) for Wisconsin, determined by Wisconsin Department of Natural Resources (WDNR 2013a).

Table 2. Industrial soil screening levels for MGP sites in Wisconsin RAF Addendum (Revision 4)

Analyte	CAS #	Selected Concentration Soil Industrial (mg/kg)	Source	Comments	U.S. EPA (2015a) RSL Soil Industrial (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Acenaphthene	83-32-9	45,000 n	RSL		45,000 n	--
Acenaphthylene	208-96-8	45,000 n	RSL	Used surrogate of acenaphthene (83-32-9)	45,000 n	--
Anthracene	120-12-7	100,000 n	max		230,000 nm	--
Benzo[a]anthracene	56-55-3	2.9 c	RSL		2.9 c	--
Benzo[a]pyrene	50-32-8	0.29 c	RSL		0.29 c	--
Benzo[b]fluoranthene	205-99-2	2.9 c	RSL		2.9 c	--
Benzo[g,h,i]perylene	191-24-2	23,000 n	RSL	Used surrogate of pyrene (129-00-0)	23,000 n	--
Benzo[k]fluoranthene	207-08-9	29 c	RSL		29 c	--
Chrysene	218-01-9	290 c	RSL		290 c	--
Dibenz[a,h]anthracene	53-70-3	0.29 c	RSL		0.29 c	--
Fluoranthene	206-44-0	30,000 n	RSL		30,000 n	--
Fluorene	86-73-7	30,000 n	RSL		30,000 n	--
Indeno[1,2,3-cd]pyrene	193-39-5	2.9 c	RSL		2.9 c	--
2-Methylnaphthalene	91-57-6	3,000 n	RSL		3,000 n	--
Naphthalene	91-20-3	17 c*	RSL		17 c*	--
Phenanthrene	85-01-8	100,000 n	max	Used surrogate of anthracene (120-12-7)	230,000 nm	--
Pyrene	129-00-0	23,000 n	RSL		23,000 n	--
Phenols						
2,4-Dimethylphenol	105-67-9	16,000 n	RSL		16,000 n	--
2-Methylphenol (o-Cresol)	95-48-7	41,000 n	RSL		41,000 n	--
3&4-Methylphenol (m&p)	108-39-4	41,000 n	RSL	Used value for m-cresol (108-39-4)	41,000 n	--
Phenol	108-95-2	100,000 n	max		250,000 nm	--
Volatile Organic Compounds						
Benzene	71-43-2	5.1 c*	RSL		5.1 c*	1,820
Ethylbenzene	100-41-4	25 c	RSL		25 c	480
Toluene	108-88-3	818 n	sat		47,000 ns	818
1,2,4-Trimethylbenzene	95-63-6	219 n	sat		240 ns	219
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		12,000 ns	182
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	2,400 ns	388
o-Xylene	95-47-6	434 n	sat		2,800 ns	434
Xylene (Total)	1330-20-7	260 n	sat		2,500 ns	260
Metals and Inorganics						
Aluminum	7429-90-5	100,000 n	max		1,100,000 nm	--
Antimony	7440-36-0	470 n	RSL	Antimony (metallic)	470 n	--
Arsenic	7440-38-2	8.0	background[1]	Arsenic, inorganic	3.0 c	--
Barium	7440-39-3	100,000 n	max		220,000 nm	--
Cadmium	7440-43-9	980 n	RSL	Dietary value	980 n	--
Chromium	7440-47-3	100,000 n	max	Cr(III) for soil	1,800,000 nm	--
Copper	7440-50-8	47,000 n	RSL		47,000 n	--
Iron	7439-89-6	100,000 n	max		820,000 nm	--
Lead	7439-92-1	800	RSL		800	--
Manganese	7439-96-5	26,000 n	RSL	Used non-dietary value	26,000 n	--
Mercury	7487-94-7	350 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	350 n	--
Nickel	7440-02-0	22,000 n	RSL	Nickel soluble salts	22,000 n	--
Selenium	7782-49-2	5,800 n	RSL		5,800 n	--
Silver	7440-22-4	5,800 n	RSL		5,800 n	--
Vanadium	7440-62-2	5,800 n	RSL		5,800 n	--
Zinc	7440-66-6	100,000 n	max		350,000 nm	--
Cyanide	57-12-5	1,200 n	RSL	Used sodium cyanide (143-33-9)	1,200 n	--

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at MGP sites. The source of the selected screening value is presented to the right of the numerical value.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2015 (U.S. EPA 2015a) (www.epa.gov/risk/risk-based-screening-table-generic-t

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.

[1] Concentration is the background threshold value (BTV) for Wisconsin, determined by Wisconsin Department of Natural Resources (WDNR 2013a).

Table 3. Residential soil screening levels for MGP sites in Illinois
RAF Addendum (Revision 4)

Analyte	CAS #	Selected Concentration Soil Residential (mg/kg)	Source	Comments	U.S. EPA (2015a) RSL Soil Residential (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Residential Ingestion (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Residential Inhalation (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Residential Ingestion (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Residential Inhalation (mg/kg)
Semivolatile Organic Compounds										
Polycyclic Aromatic Hydrocarbons										
Acenaphthene	83-32-9	3,600 n	RSL		3,600 n	--	4,700 n	--	--	--
Acenaphthylene	208-96-8	3,600 n	RSL	Used surrogate of acenaphthene (83-32-9)	3,600 n	--	--	--	2,300 n	--
Anthracene	120-12-7	18,000 n	RSL		18,000 n	--	23,000 n	--	--	--
Benzo[a]anthracene	56-55-3	0.16 c	RSL		0.16 c	--	0.9 c,w	--	--	--
Benzo[a]pyrene	50-32-8	0.016 c	RSL		0.016 c	--	0.09 c,w	--	--	--
Benzo[b]fluoranthene	205-99-2	0.16 c	RSL		0.16 c	--	0.9 c,w	--	--	--
Benzo[g,h,i]perylene	191-24-2	1,800 n	RSL	Used surrogate of pyrene (129-00-0)	1,800 n	--	--	--	2,300 n	--
Benzo[k]fluoranthene	207-08-9	1.6 c	RSL		1.6 c	--	9 c	--	--	--
Chrysene	218-01-9	16 c	RSL		16 c	--	88 c	--	--	--
Dibenz[a,h]anthracene	53-70-3	0.016 c	RSL		0.016 c	--	0.09 c,w	--	--	--
Fluoranthene	206-44-0	2,400 n	RSL		2,400 n	--	3,100 n	--	--	--
Fluorene	86-73-7	2,400 n	RSL		2,400 n	--	3,100 n	--	--	--
Indeno[1,2,3-cd]pyrene	193-39-5	0.16 c	RSL		0.16 c	--	0.9 c,w	--	--	--
2-Methylnaphthalene	91-57-6	240 n	RSL		240 n	--	--	--	310 n	--
Naphthalene	91-20-3	3.8 c*	RSL		3.8 c*	--	1,600 n	170 n	--	--
Phenanthrene	85-01-8	18,000 n	RSL	Used surrogate of anthracene (120-12-7)	18,000 n	--	--	--	2,300 n	--
Pyrene	129-00-0	1,800 n	RSL		1,800 n	--	2,300 n	--	--	--
Phenols										
2,4-Dimethylphenol	105-67-9	1,300 n	RSL		1,300 n	--	1,600 n	--	--	--
2-Methylphenol (o-Cresol)	95-48-7	3,200 n	RSL		3,200 n	--	3,900 n	--	--	--
3&4-Methylphenol (m&p)	108-39-4	3,200 n	RSL	Used value for m-cresol (108-39-4)	3,200 n	--	--	--	3,900 n	8,100 d
Phenol	108-95-2	19,000 n	RSL		19,000 n	--	23,000 n	--	--	--
Volatile Organic Compounds										
Benzene	71-43-2	1.2 c*	RSL		1.2 c*	1,820	12 c	0.8 c	--	--
Ethylbenzene	100-41-4	5.8 c	RSL		5.8 c	480	7,800 n	400 d	--	--
Toluene	108-88-3	818 n	sat		4,900 ns	818	16,000 n	650 d	--	--
1,2,4-Trimethylbenzene	95-63-6	58 n	RSL		58 n	219	--	--	--	87 n
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		780 ns	182	--	--	780 n	--
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	550 ns	388	16,000 n	420 d	--	--
o-Xylene	95-47-6	434 n	sat		650 ns	434	16,000 n	410 d	--	--
Xylene (Total)	1330-20-7	260 n	sat		580 ns	260	16,000 n	320 d	--	--
Metals and Inorganics										
Aluminum	7429-90-5	77,000 n	RSL		77,000 n	--	--	--	78,000 n	1,000,000 n
Antimony	7440-36-0	31 n	RSL	Antimony (metallic)	31 n	--	31 n	--	--	--
Arsenic	7440-38-2	13.0 / 11.3	background[1]	Arsenic, inorganic	0.68 c*	--	13.0 / 11.3 t	750 c	--	--
Barium	7440-39-3	15,000 n	RSL		15,000 n	--	5,500 n	690,000 n	--	--
Cadmium	7440-43-9	71 n	RSL	Dietary value	71 n	--	78 n,r	1,800 c	--	--
Chromium	7440-47-3	100,000 n	max	Cr(III) for soil	120,000 nm	--	230 n	270 c	--	--
Copper	7440-50-8	3,100 n	RSL		3,100 n	--	2,900 n	--	--	--
Iron	7439-89-6	55,000 n	RSL		55,000 n	--	--	--	--	--
Lead	7439-92-1	400	RSL		400	--	400 k	--	--	--
Manganese	7439-96-5	1,800 n	RSL	Used non-dietary value	1,800 n	--	1,600 n,v	69,000 n	--	--
Mercury	7487-94-7	23 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	23 n	--	23 n	--	--	--
Nickel	7440-02-0	1,500 n	RSL	Nickel soluble salts	1,500 n	--	1,600 n	13,000 c	--	--
Selenium	7782-49-2	390 n	RSL		390 n	--	390 n	--	--	--
Silver	7440-22-4	390 n	RSL		390 n	--	390 n	--	--	--
Vanadium	7440-62-2	390 n	RSL		390 n	--	550 n	--	--	--
Zinc	7440-66-6	23,000 n	RSL		23,000 n	--	23,000 n	--	--	--
Cyanide	57-12-5	78 n	RSL	Used sodium cyanide (143-33-9)	78 n	--	1,600 n	--	--	--

(footnotes on following page)

Table 3. Residential soil screening levels for MGP sites in Illinois
RAF Addendum (Revision 4)

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at MGP sites. The source of the selected screening value is presented to the right of the numerical value.

Hierarchy for soil screening criteria:
RSL, *then* TACO, *then non-TACO value.*
For all TACO and non-TACO soil remediation objectives, the lowest of the two pathway-specific (i.e., ingestion or inhalation) values is used.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2015 (U.S. EPA 2015a) (www.epa.gov/risk/risk-based-screening-table-generic-tables)

TACO and non-TACO
Illinois Tiered Approach to Corrective Action Objectives (TACO), soil remediation objectives, Title 35 Part 742 (IEPA 2013c) (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO objectives (IEPA 2012) (http://www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html)

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- d – soil saturation concentration (C_{sat}) – the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached; above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.
- k – a preliminary remediation goal of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive #9355.4-12
- r – value based on dietary reference dose
- t – values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) from 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils];
- v – value based on reference dose adjusted for dietary intake
- w – for sites located in any populated area as defined in Section 742.200, Appendix A, Table H may be used [Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils]; see text for details

[1] Concentrations are the Illinois background concentrations for arsenic from TACO. Values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) are taken from IEPA 2013c, 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils].

Table 4. Industrial soil screening levels for MGP sites in Illinois
RAF Addendum (Revision 4)

Analyte	CAS #	Selected Concentration Soil Industrial (mg/kg)	Source	Comments	U.S. EPA (2015a) RSL Soil Industrial (mg/kg)	Soil Saturation Concentration C_{sat} (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Industrial Ingestion (mg/kg)	IEPA (2013c) TACO Remediation Objective Soil, Industrial Inhalation (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Industrial Ingestion (mg/kg)	IEPA (2012) Non-TACO Remediation Objective Soil, Industrial Inhalation (mg/kg)
Semivolatile Organic Compounds										
Polycyclic Aromatic Hydrocarbons										
Acenaphthene	83-32-9	45,000 n	RSL		45,000 n	–	120,000 n	–	–	–
Acenaphthylene	208-96-8	45,000 n	RSL	Used surrogate of acenaphthene (83-32-9)	45,000 n	–	–	–	61,000 n	–
Anthracene	120-12-7	100,000 n	max		230,000 nm	–	610,000 n	–	–	–
Benzo[a]anthracene	56-55-3	2.9 c	RSL		2.9 c	–	8 c	–	–	–
Benzo[a]pyrene	50-32-8	0.29 c	RSL		0.29 c	–	0.8 c,x	–	–	–
Benzo[b]fluoranthene	205-99-2	2.9 c	RSL		2.9 c	–	8 c	–	–	–
Benzo[g,h,i]perylene	191-24-2	23,000 n	RSL	Used surrogate of pyrene (129-00-0)	23,000 n	–	–	–	61,000 n	–
Benzo[k]fluoranthene	207-08-9	29 c	RSL		29 c	–	78 c	–	–	–
Chrysene	218-01-9	290 c	RSL		290 c	–	780 c	–	–	–
Dibenz[a,h]anthracene	53-70-3	0.29 c	RSL		0.29 c	–	0.8 c	–	–	–
Fluoranthene	206-44-0	30,000 n	RSL		30,000 n	–	82,000 n	–	–	–
Fluorene	86-73-7	30,000 n	RSL		30,000 n	–	82,000 n	–	–	–
Indeno[1,2,3-cd]pyrene	193-39-5	2.9 c	RSL		2.9 c	–	8 c	–	–	–
2-Methylnaphthalene	91-57-6	3,000 n	RSL		3,000 n	–	–	–	8,200 n	–
Naphthalene	91-20-3	17 c*	RSL		17 c*	–	41,000 n	270 n	–	–
Phenanthrene	85-01-8	100,000 n	max	Used surrogate of anthracene (120-12-7)	230,000 nm	–	–	–	61,000 n	–
Pyrene	129-00-0	23,000 n	RSL		23,000 n	–	61,000 n	–	–	–
Phenols										
2,4-Dimethylphenol	105-67-9	16,000 n	RSL		16,000 n	–	41,000 n	–	–	–
2-Methylphenol (o-Cresol)	95-48-7	41,000 n	RSL		41,000 n	–	100,000 n	–	–	–
3&4-Methylphenol (m&p)	108-39-4	41,000 n	RSL	Used value for m-cresol (108-39-4)	41,000 n	–	–	–	100,000 n	8,100 d
Phenol	108-95-2	100,000 n	max		250,000 nm	–	610,000 n	–	–	–
Volatile Organic Compounds										
Benzene	71-43-2	5.1 c*	RSL		5.1 c*	1,820	100 c	1.6 c	–	–
Ethylbenzene	100-41-4	25 c	RSL		25 c	480	200,000 n	400 d	–	–
Toluene	108-88-3	818 n	sat		47,000 ns	818	410,000 n	650 d	–	–
1,2,4-Trimethylbenzene	95-63-6	219 n	sat		240 ns	219	–	–	–	140 n
1,3,5-Trimethylbenzene	108-67-8	182 n	sat		12,000 ns	182	–	–	20,000 n	–
m&p-Xylene	108-38-3	388 n	sat	Used value for m-xylene (108-38-3)	2,400 ns	388	410,000 n	420 d	–	–
o-Xylene	95-47-6	434 n	sat		2,800 ns	434	410,000 n	410 d	–	–
Xylene (Total)	1330-20-7	260 n	sat		2,500 ns	260	410,000 n	320 d	–	–
Metals and Inorganics										
Aluminum	7429-90-5	100,000 n	max		1,100,000 nm	–	–	–	1,000,000 n	1,000,000 n
Antimony	7440-36-0	470 n	RSL	Antimony (metallic)	470 n	–	820 n	–	–	–
Arsenic	7440-38-2	13.0 / 11.3	background[1]	Arsenic, inorganic	3.0 c	–	13.0 / 11.3 t	1,200 c	–	–
Barium	7440-39-3	100,000 n	max		220,000 nm	–	140,000 n	910,000 n	–	–
Cadmium	7440-43-9	980 n	RSL	Dietary value	980 n	–	2,000 n,r	2,800 c	–	–
Chromium	7440-47-3	100,000 n	max	Cr(III) for soil	1,800,000 nm	–	6,100 n	420 c	–	–
Copper	7440-50-8	47,000 n	RSL		47,000 n	–	82,000 n	–	–	–
Iron	7439-89-6	100,000 n	max		820,000 nm	–	–	–	–	–
Lead	7439-92-1	800	RSL		800	–	800 y	–	–	–
Manganese	7439-96-5	26,000 n	RSL	Used non-dietary value	26,000 n	–	41,000 n,w	91,000 n	–	–
Mercury	7487-94-7	350 n	RSL	Used Hg chloride (& other Hg salts) (7487-94-7)	350 n	–	610 n	16 n	–	–
Nickel	7440-02-0	22,000 n	RSL	Nickel soluble salts	22,000 n	–	41,000 n	21,000 c	–	–
Selenium	7782-49-2	5,800 n	RSL		5,800 n	–	10,000 n	–	–	–
Silver	7440-22-4	5,800 n	RSL		5,800 n	–	10,000 n	–	–	–
Vanadium	7440-62-2	5,800 n	RSL		5,800 n	–	14,000 n	–	–	–
Zinc	7440-66-6	100,000 n	max		350,000 nm	–	610,000 n	–	–	–
Cyanide	57-12-5	1,200 n	RSL	Used sodium cyanide (143-33-9)	1,200 n	–	41,000 n	–	–	–

(footnotes on following page)

Table 4. Industrial soil screening levels for MGP sites in Illinois
RAF Addendum (Revision 4)

Notes: This table provides the selected screening value for each analyte. If the risk-based concentration exceeds either the soil saturation concentration (C_{sat}) or the ceiling limit of 100,000 mg/kg, the appropriate value replaces the risk-based concentration as the screening level. For arsenic, the risk-based concentration is lower than state-specific soil background values, as will be documented in the baseline risk assessment. Consistent with EPA risk assessment guidance (U.S. EPA 1989; RAGs Part A), the state-specific background value will be used as the screening level for arsenic at MGP sites. The source of the selected screening value is presented to the right of the numerical value.

Hierarchy for soil screening criteria:
RSL, then TACO, then non-TACO value.
For all TACO and non-TACO soil remediation objectives, the lowest of the two pathway-specific (i.e., ingestion or inhalation) values is used.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2015 (U.S. EPA 2015a) (www.epa.gov/risk/risk-based-screening-table-generic-tables)

TACO and non-TACO
Illinois Tiered Approach to Corrective Action Objectives (TACO), soil remediation objectives, Title 35 Part 742 (IEPA 2013c) (http://www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO objectives (IEPA 2012) (http://www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html)

- c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
- c* – where the non-cancer screening level is < 100× cancer screening level
- d – soil saturation concentration (C_{sat}) – the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached; above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required
- m – concentration may exceed ceiling limit
- max – risk-based concentration above ceiling limit, so value was set to ceiling limit (100,000 mg/kg)
- n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
- s – concentration may exceed C_{sat} (soil saturation concentration)
- sat – risk-based concentration exceeded soil saturation concentration (C_{sat}), so value was set to C_{sat}.
- r – value based on dietary reference dose
- t – values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) from 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils]
- w – value based on reference dose adjusted for dietary intake
- x – for any populated areas as defined in Section 742.200, Appendix A, Table H may be used
- y – value based on maintaining fetal blood lead below 10 μg/dL, using the USEPA Adult Blood Lead Model

[1] Concentrations are the Illinois background concentrations for arsenic from TACO. Values for counties within metropolitan statistical area (13.0 mg/kg) and outside metropolitan statistical area (11.3 mg/kg) are taken from IEPA 2013c, 742.Appendix A, Table G [Concentrations of Inorganic Chemicals in Background Soils].

Table 5. Groundwater screening levels for MGP sites in Wisconsin
RAF Addendum (Revision 4)

Analyte	CAS #	Screening Criteria: U.S. EPA (2015a) RSL Tapwater (µg/L)	Screening Criteria: U.S. EPA (2009) Maximum Contaminant Level (µg/L)	Screening Criteria: WDNR (2015) NR140 Groundwater Enforcement Standard (µg/L)	Comments
Semivolatile Organic Compounds					
Polycyclic Aromatic Hydrocarbons					
Acenaphthene	83-32-9	530 n	--	--	
Acenaphthylene	208-96-8	530 n	--	--	Used surrogate of acenaphthene (83-32-9)
Anthracene	120-12-7	1,800 n	--	3,000	
Benzo[a]anthracene	56-55-3	0.012 c	--	--	
Benzo[a]pyrene	50-32-8	0.0034 c	0.2	0.2	
Benzo[b]fluoranthene	205-99-2	0.034 c	--	0.2	
Benzo[g,h,i]perylene	191-24-2	120 n	--	--	Used surrogate of pyrene (129-00-0)
Benzo[k]fluoranthene	207-08-9	0.34 c	--	--	
Chrysene	218-01-9	3.4 c	--	0.2	
Dibenz[a,h]anthracene	53-70-3	0.0034 c	--	--	
Fluoranthene	206-44-0	800 n	--	400	
Fluorene	86-73-7	290 n	--	400	
Indeno[1,2,3-cd]pyrene	193-39-5	0.034 c	--	--	
2-Methylnaphthalene	91-57-6	36 n	--	--	
Naphthalene	91-20-3	0.17 c*	--	100	
Phenanthrene	85-01-8	1,800 n	--	--	Used surrogate of anthracene (120-12-7)
Pyrene	129-00-0	120 n	--	250	
Phenols					
2,4-Dimethylphenol	105-67-9	360 n	--	--	
3&4-Methylphenol (m&p)	108-39-4	930 n	--	--	Used value for m-cresol (108-39-4)
2-Methylphenol (o-Cresol)	95-48-7	930 n	--	--	
Phenol	108-95-2	5,800 n	--	2,000	
Volatile Organic Compounds					
Benzene	71-43-2	0.46 c*	5	5	
Ethylbenzene	100-41-4	1.5 c	700	700	
Toluene	108-88-3	1,100 n	1,000	800	
1,2,4-Trimethylbenzene	95-63-6	15 n	--	--	
1,3,5-Trimethylbenzene	108-67-8	120 n	--	--	
m&p-Xylene	108-38-3	190 n	--	--	Used value for m-xylene (108-38-3)
o-Xylene	95-47-6	190 n	--	--	
Xylene (total)	1330-20-7	190 n	10,000	2,000	
Metals and Inorganics					
Aluminum	7429-90-5	20,000 n	--	200	
Antimony	7440-36-0	7.8 n	6	6	
Arsenic	7440-38-2	0.052 c	10	10	
Barium	7440-39-3	3,800 n	2,000	2,000	
Cadmium	7440-43-9	9.2 n	5	5	
Chromium	7440-47-3	22,000 n	100	100	For MCL: Cr (total); For RSL: Cr(III)
Copper	7440-50-8	800 n	1,300	1,300	
Iron	7439-89-6	14,000 n	--	--	
Lead	7439-92-1	15 n	15	15	
Manganese	7439-96-5	430 n	--	300	
Mercury	7487-94-7	5.7 n	2	2	For RSL: mercuric chloride (& other Hg salts)
Nickel	7440-02-0	390 n	--	100	For RSL: nickel soluble salts
Selenium	7782-49-2	100 n	50	50	
Silver	7440-22-4	94 n	--	50	
Vanadium	7440-62-2	86 n	--	30	
Zinc	7440-66-6	6,000 n	--	--	
Cyanide	57-12-5	20 n[a]	200 [a]	200 [a]	For RSL: sodium cyanide; For WI: cyanide, free

Notes: Site concentrations will be screened separately against all three sets of criteria. Any analyte exceeding any criteria will be considered a chemical of potential concern.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2015 (U.S. EPA 2015a) (www.epa.gov/risk/risk-based-screening-table-generic-tables)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

WI NR140: WI NR 140 groundwater quality enforcement standards published in Register 715, dated July 2015 (WDNR 2015) (http://docs.legis.wisconsin.gov/code/admin_code/nr/140.pdf)

c -- screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* -- where the non-cancer screening level is < 100× cancer screening level
n -- screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1

[a] Groundwater cyanide concentration results based on the available cyanide analysis method (OIA 1677) will be compared to cyanide groundwater criterion.

Table 6. Groundwater screening levels for MGP sites in Illinois
RAF Addendum (Revision 4)

Analyte	CAS #	Screening Criteria: U.S. EPA (2015a) RSL Tapwater (µg/L)	Screening Criteria: U.S. EPA (2009) Maximum Contaminant Level (µg/L)	Screening Criteria: Selected Illinois Groundwater Value[a] (µg/L)	IEPA (2013d) Illinois Groundwater Quality Standard Class I (µg/L)	IEPA (2013c) TACO Remediation Objective, Class I Groundwater (µg/L)	IEPA (2012) Non-TACO Remediation Objective, Class I Groundwater (µg/L)	Comments
Semivolatile Organic Compounds								
Polycyclic Aromatic Hydrocarbons								
Acenaphthene	83-32-9	530 n	–	420 QS	420	420	–	
Acenaphthylene	208-96-8	530 n	–	210 non-TACO	–	–	210	Used surrogate of acenaphthene (83-32-9) for RSL
Anthracene	120-12-7	1,800 n	–	2,100 QS	2,100	2,100	–	
Benzo[a]anthracene	56-55-3	0.012 c	–	0.13 QS	0.13	0.13	–	
Benzo[a]pyrene	50-32-8	0.0034 c	0.2	0.2 QS	0.2	0.2	–	
Benzo[b]fluoranthene	205-99-2	0.034 c	–	0.18 QS	0.18	0.18	–	
Benzo[g,h,i]perylene	191-24-2	120 n	–	210 non-TACO	–	–	210	Used surrogate of pyrene (129-00-0) for RSL
Benzo[k]fluoranthene	207-08-9	0.34 c	–	0.17 QS	0.17	0.17	–	
Chrysene	218-01-9	3.4 c	–	12 QS	12	1.5	–	
Dibenz[a,h]anthracene	53-70-3	0.0034 c	–	0.3 QS	0.3	0.3	–	
Fluoranthene	206-44-0	800 n	–	280 QS	280	280	–	
Fluorene	86-73-7	290 n	–	280 QS	280	280	–	
Indeno[1,2,3-cd]pyrene	193-39-5	0.034 c	–	0.43 QS	0.43	0.43	–	
2-Methylnaphthalene	91-57-6	36 n	–	28 QS	28	–	28	
Naphthalene	91-20-3	0.17 c*	–	140 QS	140	140	–	
Phenanthrene	85-01-8	1,800 n	–	210 non-TACO	–	–	210	Used surrogate of anthracene (120-12-7) for RSL
Pyrene	129-00-0	120 n	–	210 QS	210	210	–	
Phenols								
2,4-Dimethylphenol	105-67-9	360 n	–	140 TACO	–	140	–	
2-Methylphenol (o-Cresol)	95-48-7	930 n	–	350 QS	350	350	–	
3&4-Methylphenol (m&p)	108-39-4	930 n	–	350 non-TACO	–	–	35	Used value for m-cresol (108-39-4)
Phenol	108-95-2	5,800 n	–	100 QS	100	100	–	
Volatile Organic Compounds								
Benzene	71-43-2	0.46 c*	5	5 QS	5	5	–	
Ethylbenzene	100-41-4	1.5 c	700	700 QS	700	700	–	
Toluene	108-88-3	1,100 n	1,000	1,000 QS	1,000	1,000	–	
1,2,4-Trimethylbenzene	95-63-6	15 n	–	–	–	–	–	
1,3,5-Trimethylbenzene	108-67-8	120 n	–	70 non-TACO	–	–	70	
m&p-Xylene	108-38-3	190 n	–	–	–	–	–	Used value for m-xylene (108-38-3) for RSL
o-Xylene	95-47-6	190 n	–	–	–	–	–	
Xylene (total)	1330-20-7	190 n	10,000	10,000 QS	10,000	10,000	–	
Metals and Inorganics								
Aluminum	7429-90-5	20,000 n	–	3,500 non-TACO	–	–	3,500	
Antimony	7440-36-0	7.8 n	6	6 QS	6	6	–	
Arsenic	7440-38-2	0.052 c	10	10 QS	10	50	–	
Barium	7440-39-3	3,800 n	2,000	2,000 QS	2,000	2,000	–	
Cadmium	7440-43-9	9.2 n	5	5 QS	5	5	–	
Chromium	7440-47-3	22,000 n	100	100 QS	100	100	–	For MCL: Cr (total); For RSL: Cr(III)
Copper	7440-50-8	800 n	1,300	650 QS	650	650	–	
Iron	7439-89-6	14,000 n	–	5,000 QS	5,000	5,000	–	
Lead	7439-92-1	15	15	7.5 QS	7.5	7.5	–	
Manganese	7439-96-5	430 n	–	150 QS	150	150	–	
Mercury	7487-94-7	5.7 n	2	2 QS	2	2	–	For RSL: mercuric chloride (& other Hg salts)
Nickel	7440-02-0	390 n	–	100 QS	100	100	–	For RSL: nickel soluble salts
Selenium	7782-49-2	100 n	50	50 QS	50	50	–	
Silver	7440-22-4	94 n	–	50 QS	50	50	–	
Vanadium	7440-62-2	86 n	–	49 QS	49	49	–	
Zinc	7440-66-6	6,000 n	–	5,000 QS	5,000	5,000	–	
Cyanide	57-12-5	20 n[b]	200 [b]	200 QS[b]	200	200	–	For RSL: sodium cyanide (143-33-9)

(footnotes on following page)

Table 6. Groundwater screening levels for MGP sites in Illinois
RAF Addendum (Revision 4)

Notes: Site concentrations will be screened separately against all three sets of criteria. Any analyte exceeding any criteria will be considered a chemical of potential concern.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2015 (U.S. EPA 2015a) (www.epa.gov/risk/risk-based-screening-table-generic-tables)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

Illinois standards or objectives

Illinois Groundwater Quality Standards for Class I: Potable Resource, Title 35 Part 620 (IEPA 2013d) (www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois Tiered Approach to Corrective Action Objectives (TACO), groundwater remediation objectives, Title 35 Part 742 (IEPA 2013c) (www.ipcb.state.il.us/SLR/IPCBandIEPAEnvironmentalRegulations-Title35.aspx)
Illinois non-TACO objectives (IEPA 2012) (www.epa.state.il.us/land/taco/chemicals-not-in-taco-tier-1-tables.html)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
non-TACO – value is the Illinois non-TACO objective
QS – value is the Illinois groundwater quality standard
TACO – value is the Illinois TACO groundwater remediation objective

[a] Hierarchy for selected Illinois groundwater screening criteria: Groundwater quality standard, then TACO remediation objective, then non-TACO remediation objective.
[b] Groundwater cyanide concentration results based on the available cyanide analysis method (OIA 1677) will be compared to cyanide groundwater criterion.

Table 7. Residential vapor intrusion screening levels for MGP sites in Illinois and Wisconsin RAF Addendum (Revision 4)

Analyte	CAS #	Selected Risk-Based Concentrations, Residential: Indoor Air RSL (µg/m³)	Soil Gas (µg/m³)	Groundwater, Vapor Intrusion (µg/L)	Comments for Selected Value	U.S. EPA (2009) Maximum Contaminant Level (µg/L)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Naphthalene	91-20-3	0.083 c*	2.8 c	4.6 c		--
Volatile Organic Compounds						
Benzene	71-43-2	0.36 c	12 c	1.6 c	MCL is higher than groundwater VI value	5
Ethylbenzene	100-41-4	1.1 c	37 c	3.5 c	MCL is higher than groundwater VI value	700
Toluene	108-88-3	5,200 n	170,000 n	19,000 n		1,000
1,2,4-Trimethylbenzene	95-63-6	7.3 n	240 n	29 n		--
1,3,5-Trimethylbenzene	108-67-8	7.3 n	240 n	20 n	Used RfC for 1,2,4-trimethylbenzene	--
m&p-Xylene	108-38-3	100 n	3,500 n	360 n	Used value for m-xylene (108-38-3)	--
o-Xylene	95-47-6	100 n	3,500 n	490 n		--
Xylene (total)	1330-20-7	100 n	3,500 n	490 n	MCL is higher than groundwater VI value	10,000

Notes:

The vapor intrusion soil gas and groundwater screening values are based on the indoor air RSL, and derived using EPA's Vapor Instrusion Screening Level Calculator, Version 3.4 (updated using June 2015 RSLs, epa.gov/oswer/vaporintrusion/guidance.html).

The groundwater vapor intrusion values are based on a default groundwater temperature of 25°C. Only analytes that are sufficiently volatile and have available inhalation toxicity values are presented.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2015 (U.S. EPA 2015a) (www.epa.gov/risk/risk-based-screening-table-generic-tables)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
NVT – not sufficiently volatile and/or toxic to pose inhalation risk in selected exposure scenario for the indicated medium
RfC – reference concentration
VI – vapor intrusion

Table 8. Industrial vapor intrusion screening levels for MGP sites in Illinois and Wisconsin RAF Addendum (Revision 4)

Analyte	CAS #	Selected Risk-Based Concentrations, Industrial: Indoor Air RSL (µg/m³)	Soil Gas (µg/m³)	Groundwater, Vapor Intrusion (µg/L)	Comments for Selected Value	U.S. EPA (2009) Maximum Contaminant Level (µg/L)
Semivolatile Organic Compounds						
Polycyclic Aromatic Hydrocarbons						
Naphthalene	91-20-3	0.36 c*	12 c	20 c		--
Volatile Organic Compounds						
Benzene	71-43-2	1.6 c*	52 c	6.9 c		5
Ethylbenzene	100-41-4	4.9 c	160 c	15 c	MCL is higher than groundwater VI value	700
Toluene	108-88-3	22,000 n	730,000 n	81,000 n		1,000
1,2,4-Trimethylbenzene	95-63-6	31 n	1,000 n	120 n		--
1,3,5-Trimethylbenzene	108-67-8	31 n	1,000 n	86 n	Used RfC for 1,2,4-trimethylbenzene	--
m&p-Xylene	108-38-3	440 n	15,000 n	1,500 n	Used value for m-xylene (108-38-3)	--
o-Xylene	95-47-6	440 n	15,000 n	2,100 n		--
Xylene (total)	1330-20-7	440 n	15,000 n	2,100 n	MCL is higher than groundwater VI value	10,000

Notes:

The vapor intrusion soil gas and groundwater screening values are based on the indoor air RSL, and derived using EPA's Vapor Instrusion Screening Level Calculator, Version 3.4 (updated using June 2015 RSLs, epa.gov/oswer/vaporintrusion/guidance.html).

The groundwater vapor intrusion values are based on a default groundwater temperature of 25°C. Only analytes that are sufficiently volatile and have available inhalation toxicity values are presented.

RSLs: U.S. EPA Regional Screening Levels (RSLs), updated November 2015 (U.S. EPA 2015a) (www.epa.gov/risk/risk-based-screening-table-generic-tables)

MCLs: Maximum Contaminant Levels (MCL) national primary drinking water standards (U.S. EPA 2009) (http://water.epa.gov/drink/contaminants/index.cfm)

c – screening value based on cancer effects; calculated values correspond to a cancer risk level of 1 in 1,000,000
c* – where the non-cancer screening level is < 100× cancer screening level
n – screening value based on non-cancer effects; calculated values correspond to a target hazard quotient of 1
NVT – not sufficiently volatile and/or toxic to pose inhalation risk in selected exposure scenario for the indicated medium
RfC – reference concentration
VI – vapor intrusion